Notes

Atomic Energy Control Board | Commission de contrôle de l'énergie atomique

INFORMATION BULLETIN 86-1 July 8, 1986

REGULATORY RESEARCH PROGRAM FOR 1986/87
PROJECT DESCRIPTIONS

The Regulatory Research Program is intended to augment and extend the Atomic Energy Control Board's regulatory program beyond the capability of in-house resources. The overall objective of the research program is to produce pertinent and independent information that will assist the Board and its staff in making correct, timely and credible decisions on regulating nuclear energy.

The program is divided into ten main areas of research covering the safety of nuclear facilities, radioactive waste management, health physics, physical security and the development of regulatory processes. A total of 92 projects are planned for 1986/87, including a number which are ongoing from the previous fiscal year.

Most of the projects will be carried out under contracts issued through Supply and Services Canada.

This Information Bulletin contains a list of the projects with a brief description of each.

A separate document describing how the AECB Regulatory Research Program is administered (INFO-0157) may be obtained by contacting:

Atomic Energy Control Board
Office of Public Information
P.O. Box 1046
Ottawa, Canada
K1P 5S9

Telephone: (613) 995-5894

- 30 -

EXPLANATION OF PROJECT SUMMARIES

A. Project Number (unique to project)
- first two digits: year the project was proposed and listed; not necessarily the year in which contract is issued.
- middle digit: number of the Mission Object (see main headings in the list; 1. "Nuclear Reactors" to 10. "Security").
- last digit: item number within the Mission Object for the year in question.

B. Title

C. Summary
The three paragraphs state:

- WHAT is proposed or in progress and by what means
- WHY this project (the justification)
- HOW it is intended to use the results.

D. Funding

Previous Years:	Year Prior to Program Year:	Program Year:	Year after Program Year:	Subsequent Years:	Project Total

- Actual expenditures are shown for past years.
- Budgeted amount is shown for the program year; but this amount is subject to change. For Category 2 items (see below) the amount may be quite speculative.
- Amounts shown for years after the program year can be very speculative.

E. Project Manager (P.M.)
Name of officer within the Regulatory Research Branch responsible for the project (to the extent that the AECB is committed, in the case of joint projects).

F. Proponent
Origin of the proposal.

G. Category
#1- Projects intended to be initiated or continued in the program year.
#2- Could be Category "1" but depend on outcome of other work, e.g. on the results of a feasibility study.
#3- Projects deferred to next or subsequent years or held in reserve in the event that funds become available in the program year.

H. Evaluator
The name of AECB person or division to give advice to or for liaison with the Project Manager on certain technical aspects of the project. The evaluator assesses the quality of work done by the contractor and also assesses how the results of the project may be used by the AECB, through a post-project evaluation.

I. Review Panel
The Review Panel is a group of internal and external experts set up by the AECB to give advice to the Project Manager on some or all aspects of the project. A panel is automatically included in the post-project evaluation, even if not so shown in block H.

86.02.03

STANDARD ABBREVIATIONS AECB ORGANIZATIONAL UNITS		SIGLES COURANTS DES UNITÉS ORGANISATIONNELLES DE LA CCEA
1. Office of the President	OPR	Bureau du Président
2. Advisory Committee on Radiation Protection	ACRP	Comité consultatif de la radioprotection
3. Advisory Committee on Nuclear Safety	ACNS	Comité consultatif de la sûreté nucléaire
4. Secretariat	SEC	Secrétariat
5. Secretary to the Board	SEB	Secrétaire de la Commission
6. Office of Public Information	OPI	Bureau d'information publique
7. Advisory Committee Secretariat	ACS	Secrétariat des groupes consultatifs
8. Legal Services Unit	LSU	Services juridiques
9. Official Languages Adviser	CLO	Conseiller en langues officielles
10. Medical Liaison Officer	MLO	Agent de liaison médical
11. Orientation Centre	ORC	Centre d'orientation
12. Directorate of Reactor Regulation	DRR	Direction générale, Réglementation des réacteurs
13. Safety Evaluation Division	SED	Division, Évaluation de la sûreté
14. Components and Quality Assurance Division	CQAD	Division, Composants et assurance-qualité
15. Power Reactor Division A	PRDA	Division «A», Réacteurs de puissance
16. Power Reactor Division B	PRDB	Division «B», Réacteurs de puissance
17. Operator Certification and Research Facility Division	OCRFD	Division, Accréditation des opérateurs et établissements de recherche
18. Directorate of Fuel Cycle and Materials Regulation	DFC	Direction générale, Réglementation des matières nucléaires et des radioéléments

19.	Office of Safeguards and Physical Security	OSS	Bureau des garanties et de la sécurité matérielle
20.	Safeguards and Security Division	SSD	Division, Garanties et sécurité
21.	Radioisotopes and Transportation Division	RTD	Division, Radio-isotopes et transports
22.	Compliance Services and Laboratories	CSLD	Division, Contrôles et laboratoires
23.	Uranium Mine Division	UMD	Division, Mines d'uranium
24.	Waste Management Division	WMD	Division, Gestion des déchets
25.	Fuel and Heavy Water Plant Division	FWD	Division, Usines de combustibles et d'eau lourde
26.	Planning and Administration Branch	PAB	Direction, Planification et administration
27.	Planning and Coordination Section	PCS	Section, Planification et coordination
27A.	Administration Division	ADD	Division, Administration
28.	Finance Section	FIS	Section, Finances
29.	Personnel Section	PES	Section, Personnel
30.	Information Management Section	IMS	Section, Traitement de l'information
31.	Regulatory Research Branch	RRB	Direction, Études normatives
32.	Radiation Protection Division	RPD	Division, radioprotection
33.	Health Effects and Regulatory Documents Section	HRS	Section, Effets sur la santé et documents de réglementation
34.	Safety and Safeguards Section	SSS	Section, Sûreté et garanties
Editorial Support Services (OPI)		SAR	Service d'appui à la rédaction
Project Office	- Bruce	POB	Bureau de projet - Bruce
	- Darlington	POD	- Darlington
	- Gentilly	POG	- Gentilly
	- Point Lepreau	POL	- Point Lepreau
	- Pickering	POP	- Pickering

Laboratory	LAB	Laboratoire
Regional Offices -		Bureaux régionaux -
Central Region	CRO	Région central
Eastern Region	ERO	Région de l'Est
Southern Ontario Region	SORO	Région du Sud de l'Ontario
Western Region	WRO	Région de l'Ouest
Elliot Lake	ELO	Elliot Lake
Accommodation and Material Management	AMM	Gestion des locaux et du matériel
Records Office	REC	Bureau des documents
Library	LIB	Bibliothèque
Administrative Support Group (Floor)	AS4 AS5 AS6 AS7 AS8	Groupe de soutien administratif (Étage)

09 April 1986

REGULATORY RESEARCH PROGRAM FOR 1986/87

1. Nuclear Reactors

84.1.6 Instrument Behaviour under Off-Normal Conditions

It is proposed to conduct a study on the behaviour, during and after selected hypothetical severe accident conditions, of instruments used in CANDU reactors. Emphasis would be placed on the accuracy of thermocouples, pressure transducers and flow meters when they operate at the extremes of, or outside, their scales.

Information on instrument behaviour during and after severe accident conditions is scarce. This work, therefore, would generate new knowledge necessary to improve the understanding of instrument readings during abnormal events.

The results of this study would be used in assessing licensee assumptions regarding accident scenarios.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: A. Omar
Category: 1

Proponent: SSS
Evaluator: SED/PRD
Review Panel: No

84.1.12 Criteria for Identification and Evaluation of Fire Hazards

A contract is under way to develop a comprehensive methodology for assessing fire protection measures in CANDU nuclear power plants.

In the safety analyses of CANDU nuclear power plants it is a requirement that consideration be given to potential fire hazards. The information that would be produced by this contract is necessary to ensure that AECB staff remain in a position to assess authoritatively such hazards.

The results of the contract would be of use to AECB staff in the assessment of licence applications and in the formulation of guidelines appropriate to fire hazards in CANDU nuclear power plants.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$12K	$24K	$70K			$106K

Project Manager: D.J. Martin
Category: 1

Proponent: SED
Evaluator: B. Finigan
Review Panel: No

84.1.13 Hydrogen Absorption in Zircaloy at High Temperatures

It is proposed to perform experiments to determine whether hydrogen could be absorbed rapidly in Zircaloy at high temperature under hypothetical accident conditions in CANDU reactors. The tasks would include determining the migration rate of hydrogen to colder metal and the resulting degree of pressure tube embrittlement. An earlier phase of this project addressed the rationale of the proposed program, and was completed in FY 84/85.

Information is required by AECB staff on the severity and the size of the problem of hydrogen absorption in Zircaloy at high temperatures.

The outcome of this proposed experimental project would be used in assessing licence submissions on severe accidents which involve pressure tubes at high temperatures.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$18K		$25K			$43K

Project Manager: J. Pachner
Category: 3

Proponent: SED
Evaluator: V. Tang
Review Panel: No

84.1.17 Computer Software Quality Assurance

A project is under way which will survey the world literature on latest developments in computer software quality assurance (QA) programmes. The survey would identify what are considered to be the best applicable standards and techniques for QA programmes during the initial development of the software and then subsequently identify applicable standards and techniques for the maintenance and preservation of the software during operation.

The work is proposed because it is essential to have adequate QA procedures for computer software. The AECB therefore needs to be aware of methods for evaluating the adequacy of software QA programmes.

The results of the study will be used in the assessment of licensee software QA programmes and in formulating regulatory requirements for such programmes.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$6K	$14K			$20K

Project Manager: D.E. Connelly
Category: 1

Proponent:
Evaluator: D. Scrimger, M.J. Massicotte
Review Panel: No

84.1.20 A Tool to Analyze Real-Time Programs

A project is proposed to survey the latest developments in computer program analysis and testing, using graph theory as applied to real-time critical systems. Then, based on the results of the survey, it is proposed to acquire or develop a program graphing software tool to analyze the complexity and verification/validation test coverage aspects of safety-related nuclear system software.

Due to the combination of the number of inputs and processing pathways, computer programs used to control nuclear reactor systems are very difficult to verify and validate to an acceptable degree of confidence. Even using extensive test data some design and programming faults may go undetected resulting in the possibility of a critical failure at some future time given a certain set of input and processing conditions.

The results of the survey phase would provide AECB staff with the latest information concerning analysis of critical software, enabling a knowledgeable assessment of the particular methods and test data used by licensees to verify and validate their nuclear software. The resulting software tool may provide an effective means for AECB staff to rigourously and independently evaluate the testability of a particular system and the extent of test coverage proposed by the licensee.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K			$60K

Project Manager: D.E. Connelly
Category: 1
Proponent: SED/RRB
Evaluator: D.E. Connelly
Review Panel: Yes

84.1.26 Review of Control Room Emergency Operating Procedures

It is proposed to continue a project which will review recent approaches to the development of nuclear plant control room emergency operating procedures and assess the need for improved emergency operating procedures in CANDU nuclear power plant control rooms. In addition, the project will develop a set of criteria for regulatory assessment of existing or proposed CANDU control room emergency operating procedures.

This project was prompted by published new approaches to the development of control room emergency operating procedures coupled with the need for the AECB to establish regulatory assessment criteria on the topic.

The results of this human factors project would be used by the AECB to identify potential inadequacies in existing nuclear power plant control room emergency operating procedures and to assess proposed changes to these procedures.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$44K	$56K			$100K

Project Manager: D.J. Martin
Category: 1
Proponent: SED
Evaluator: E.L. Gorrell
Review Panel: No

84.1.30 Fuel/Moderator Interaction after Pressure Tube Rupture

It is proposed to conduct a study to investigate the potential for steam explosion resulting from molten fuel/moderator interaction following a postulated fuel channel blockage accident. The investigation would involve a critical review of the available experimental and analytical information on the subject.

The study would provide AECB staff with independent information with which to assess whether a steam explosion could occur in, and whether existing models are adequate to describe, a fuel channel blockage event in a CANDU reactor.

The results of this study would be used by AECB staff in assessing licence submissions on fuel channel blockage accidents.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$32K	$17K			$49K

Project Manager: A. Omar
Category: 1
Proponent: SED
Evaluator: V. Tang/B. Jarman
Review Panel: No

84.1.31 Secondary Side Heat Sink Performance

A project is proposed which would provide a computer simulation of the performance of the secondary side heat sinks of a nuclear reactor.

Current safety analyses do not include all the factors which affect the secondary side response to plant transients - factors such as control algorithms, default values in software, component protection, etc. The proposed project would identify all such constraints and simulate their interaction with the physical performance of the secondary side to obtain a more realistic indication of the secondary site response.

The output of the project would be a computer simulator which would enable AECB staff to evaluate more fully the assumptions in existing safety analyses which address heat sink adequacy.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: D.J. Martin
Category: 3
Proponent: SED
Evaluator: C.T. Downie
Review Panel: No

84.1.32 Vibration Probe Monitoring of Structure Deterioration

It is proposed to conduct a study on the possible use of vibration probes for monitoring the long-term deterioration of CANDU structures such as supports for vessels and piping.

Changes that occur with time in vibration frequency and mode shape may be precursors to structural deterioration. This work would develop a monitoring system and address the accuracy required to achieve estimates of the degree of deterioration. This work will not be proposed for commencement until the results of 84.1.39 have been assessed.

The results of the project would assist AECB staff in deciding whether vibration monitoring is a potentially valuable diagnostic tool that should be installed in nuclear plants.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K			$25K

Project Manager: J. Pachner
Category: 2
Proponent: SED
Evaluator: K. Asmis
Review Panel: No

85.1.3 Reliability of Microcircuits in Nuclear Power Plants

It is proposed to conduct a study to collect and critically review available information on the limitations of microcircuits used in a nuclear environment.

Microcircuits are being used more extensively for control and monitoring functions in nuclear power plant designs. Since these circuits operate on very small currents, it is necessary to have state-of-the-art information on their susceptibility to transients and other external influences which may affect their operation.

The results of the proposed work would be used to evaluate the adequacy of present licensee design guidelines with regard to the use, qualification and separation of microcircuits in certain areas of nuclear power plants.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$10K	$15K			$25K

Project Manager: D.E. Connelly
Category: 1
Proponent: PRD-B
Evaluator: G.R. Schwarz/D.E. Connelly
Review Panel: No

85.1.4 Aerosols and Fission Product Transport

A project is proposed to investigate the potential effects of aerosols on fission product transport within and without reactor containment, and to assess mathematical models and computer codes used to describe aerosol behaviour.

Recent advances in the modelling of fission product behaviour in containment are resulting in decreases in the predicted quantities of gas-phase radioisotopes available to contribute to public radiation doses after a postulated accident in a CANDU nuclear power plant. This implies that the relative importance of the airborne liquid-phase and airborne solid-phase components has been increased. The intent of this project would be to perform an initial evaluation of the extent of this potential contribution to doses, and to assess the suitability of available mathematical models for CANDU safety analyses.

The results of this project would be of use to AECB staff both in the formulation of guidelines and requirements for safety analyses and in the assessment of future license applications for CANDU nuclear power plants in which aerosol modelling may be included.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K	$35K		$60K

Project Manager: D.E. Connelly
Category: 1
Proponent: SED
Evaluator: R. Ferch
Review Panel: No

85.1.7 The Use of Full-Scope Simulators in Training and Qualification

A project is proposed which would encompass a review of and recommendations for methods by which CANDU nuclear power plant control room operators and shift supervisors could be tested by the utilities during training, and by the AECB for certification purposes using full-scope simulators. This project would also develop an experimental method for evaluating full-scope simulator testing methods.

This project is required to support the activities of the AECB Operator Certification Group and to ensure that control room operators and shift supervisors are suitably tested by the utilities during simulator training and are effectively examined by the AECB on full scope simulators for certification purposes.

The result of this project will be used by the AECB Operator Certification Group to assess the adequacy of the utilities' simulator testing methods for shift supervisors and control room operators and in the continuing development of effective certification examinations.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: D.J. Martin
Category: 1

Proponent: OCRFD
Evaluator: F. Davediuk
Review Panel: No

85.1.8 Crack Propagation in Tough Ductile Materials

It is proposed: a) To perform experimental work which would examine elastic-plastic fracture behaviour in steels which are typical of materials used in CANDU primary heat transport systems; and to explore whether small specimen tests can be used to characterize "lower bound" crack behaviour under the range of elastic-plastic strain conditions encountered in CANDU primary heat transport system components (Phase 1). b) To evaluate the effectiveness of crack displacement and energy based fracture toughness methods of describing crack propagation behaviour under elastic-plastic strain conditions. This should include studies of the individual approaches and an investigation into the viability of a combined energy and crack displacement approach as a route towards a representative model for a wide range of crack growth (Phase 2).

The project arises from the recommendations of a recently completed review of crack and fracture behaviour in tough, ductile materials (84.1.38), which showed a need to incorporate elastic-plastic fracture mechanics considerations into the analysis and design of metalic structural components. The project is aimed at the eventual development of a practical method for the analysis and assessment of stable crack growth under elastic-plastic strain conditions.

The results of the project would be used as reference information to enable more effective appraisal of safety margins in defect dispositioning and other crack stability assessment work.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$75K	$15K		$90K

Project Manager: J. Pachner
Category: 1

Proponent: CQAD
Evaluator: J.K. Pereira
Review Panel: No

85.1.9 Ultrasonic Defect-Sizing Using Decibel Drop-Off Methods

It is proposed to conduct a literature review to investigate the effectiveness of the decibel drop-off technique in sizing defects. Studies would be conducted using beam axial and beam profile methods at various dropping levels. This would be a follow-up to a previous study (84.1.28) in which a general review of ultrasonic techniques was carried out.

Due to the diversity of defect-sizing methods which are based on the decibel drop-off technique, the accuracy and repeatability of the technique have become a matter of importance. Information is, therefore, needed to provide an independent assessment of the limits of applicability of the decibel drop-off methods.

The results of this project would be used in evaluating licence submissions involving the use of decibel drop-off methods in the sizing of defects in welds, piping, pipe fittings and pressure vessels.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$9K	$25K			$34K

Project Manager: A. Omar
Category: 1
Proponent: CQAD
Evaluator: G. Yih/W.A. Grant
Review Panel: No

85.1.10 Simulation of Darlington NGS Shutdown and Regulating Systems

It is proposed to fund a project to modify the computer-based interactive simulation program SLISIM to model the features of the shutdown and regulating systems of Darlington NGS. In addition, the opportunity would be taken to improve the presentation of the output of the program.

Analysis of possible interactions between reactor shutdown and regulating systems involves the simultaneous consideration of many variables. The most effective tool for assisting an analyst is a simulation program. Such a program, called SLISIM, has already been developed for the AECB. The program was specifically tailored to model the features of a 600 MW CANDU reactor. The AECB wishes to repeat the study of potential interactions of shutdown and regulating systems for the proposed Darlington NGS, and therefore SLISIM has to be modified.

The results of the project would be an interactive simulation program which would be used in the AECB safety review of the proposed Darlington NGS.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$1K	$29K			$30K

Project Manager: D.J. Martin
Category: 1
Proponent: SED
Evaluator: C.T. Downie
Review Panel: No

85.1.11 Mode Shape and Frequency Identification for Seismic Analysis II

It is proposed to continue with a study to explore the feasibility of using broad band background vibrations to determine mode shapes and frequencies of structures and components in a nuclear power plant. The

work proposed includes improvement of the speed and accuracy of the method developed during Phase I of the Study, and its experimental verification.

The information is needed to help decide whether vibration probes can be used to verify analytically derived frequencies and mode shapes of key seismically qualified components.

The results of this contract would inform AECB staff of the type and location requirements of transducers, the type of equipment and the techniques required for data acquisition and reduction, the accuracy that can be achieved and the approximate cost of installing such a vibration identification system.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$24K	$54K	$3K			$81K

Project Manager: J. Pachner
Category: 1

Proponent: SED
Evaluator: G.J.K. Asmis
Review Panel: No

86.1.1 Selection of Equipment for Equipment Qualification

It is proposed to identify equipment and components of CANDU NPPs whose impairment could result in significant impact on plant safety and which, therefore, should be qualified for exposure to accident and post-accident environmental conditions. This identification would be based on a review of existing reliability analyses, safety design matrices and expert knowledge of the design and operation of the plant systems.

Comprehensive environmental qualification of NPP equipment will be carried out for the first time in Canada for the Darlington NPP. As a result, AECB staff will have to assess the adequacy of equipment qualification as a part of the Darlington NPP licensing process. In addition, AECB staff wish to review the environmental qualification of safety-related equipment in already operating plants.

This project would identify the significant safety-related equipment and components that should be qualified for the Darlington NPP, and which should be considered for qualification at operating NPPs. Using the results of the work, AECB staff would be able to confirm whether the identified equipment and components were included in the equipment qualification process.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: J. Pachner
Category: 1

Proponent: SSS
Evaluator: J.P. Marchildon/R.A. Thomas
Review Panel: No

86.1.2 Technical Basis for Equipment Qualification Assessments

It is proposed to fund a project which has the following objectives:
a) to compile existing Canadian and foreign regulatory requirements and industry standards pertinent to NPP equipment qualification (EQ) and to determine the currency of these requirements in the light of up-to-date research results;
b) to prepare an EQ review procedure for use by the AECB in assessing EQ licensing submissions; and
c) to recommend evaluation criteria for use in the assessment of CANDU EQ licensing submissions.

Canadian regulatory requirements for the EQ of NPP equipment are expressed in general terms in proposed regulatory guides for the special safety systems. However, no criteria or guidelines that would establish which qualification methods are acceptable are given. Thus, it is important to develop a technical basis for review of EQ licensing submissions.

The project will produce a documented technical basis, a review procedure, and evaluation criteria for use by AECB staff in the assessment of Darlington EQ licensing submissions, and in the assessment of the adequacy of the environmental qualification of selected safety equipment and components in operating NPPs.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K			$40K

Project Manager: J. Pachner
Category: 1
Proponent: SSS
Evaluator: J.P. Marchildon/R.A. Thomas
Review Panel: No

86.1.3 Survey of NPP Environments for Equipment Qualification

It is proposed: a) to determine the expected type and range of actual plant environments (in selected plants and plant areas) to which various safety-related equipment and components are normally exposed during their service life; and b) to assess if the currently used accelerated aging methods account for these environments. The contractor would obtain available data on measured plant environments (e.g. radiation, thermal, mechanical stress, gas), and, as necessary, would measure actual environments during plant operation in selected plants and plant areas, and would assess the type and range of the environments and their simulation by the currently used accelerated aging methods.

To assure a conservative basis for equipment qualification testing, equipment should be tested in a state equivalent to the end-of-qualified life condition. Since it is not practical to naturally age equipment to the end-of-life condition, accelerated aging techniques are used to change the equipment to be tested to a state equivalent to end-of-life. To be able to simulate natural aging, actual plant environments must be known.

The project results would enable AECB staff to assess whether the accelerated aging methods reported in EQ licensing submissions adequately account for normal NPP environments.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K			$30K

Project Manager: J. Pachner
Category: 3

Proponent: SSS
Evaluator: R.A. Thomas/J.P. Marchildon
Review Panel: No

86.1.4 Assessment of NPP Aging and NPP Maintenance Programs

It is proposed to fund a project which has the following objectives:
a) to compile and evaluate information on aging effects that have occurred to date in selected types of electrical and mechanical components and materials in complex industrial plants and which could result in degradation of the performance of such components over the expected plant life;
b) to identify failure modes related to the aging and service wear of the components;
c) to identify precursor indicators of the potential failure modes that could be monitored at reasonable cost and plant operator radiation dose to detect approach to failure at an early stage;
d) to identify any standards relating to aging that are applicable to CANDU NPPs; and
e) to recommend criteria for the evaluation of NPP equipment monitoring and maintenance programs to determine whether these programs adequately account for aging and service wear effects that could have a significant effect on plant safety.
The project work would involve a survey, review and evaluation of complex industrial plant (including NPP) operating experience, equipment monitoring and maintenance practices, and a review of the relevant literature.

As the components in nuclear power plants get older, the aging and service wear they experience may have an impact on their ability to perform their intended functions. Only a few industrial standards provide guidance on equipment monitoring and maintenance. These standards are very general in nature and deal only with a limited number of component types. Thus, the availability of a well-founded methodology for the assessment of aging of critical components, equipment and systems, and their impact on plant safety would be of value. The proposed project would be the starting point in the development of this methodology.

The information generated by this project would be used by AECB staff as an initial technical basis for assessing the impact of aging of NPP equipment on plant safety and for the possible development of regulatory requirements. Furthermore, the results would allow AECB staff to review and assess the adequacy of NPP monitoring, maintenance and replacement programs related to the detection and mitigation of aging and service wear effects in NPP equipment.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K	$60K		$90K

Project Manager: J. Pachner
Category: 1
Proponent: SSS
Evaluator: R.A. Thomas/J.P. Marchildon
Review Panel: No

86.1.8 Pump Behaviour and Piping Stress under Off-Design Loadings - Feasibility Study

It is proposed to examine the feasibility of conducting an experimental program to investigate the behaviour under two-phase conditions of a scaled-down pump, equivalent to a CANDU heat transport pump, with a variable speed motor. Using the same pump with some modifications in the piping system, it is further proposed to examine the feasibility of performing a series of experiments to identify the stresses and failure modes of a simulated primary heat transport piping system when subjected to irregular hydraulic loadings generated by off-design operating conditions of the main coolant pumps. Typically, off-design operation would include that expected during loss-of-coolant accidents.

In full-scale tests conducted by a licensee, pump suction voidage could not be measured. This parameter is important in characterizing pump performance under two-phase conditions, and should be possible to measure with smaller diameter pipes. In addition, pump operation under off-design conditions could lead to violent vibration and possible failure of piping. Representative experiments in which test conditions could lead to damaging full-size pumps and piping are not normally performed because of the high cost. Therefore, the necessary data can only reasonably be obtained by the proposed use of scaled pumps.

The findings of this feasibility study would indicate whether, and at what cost, the proposed experiments could be performed. If such experiments were to be carried out, the information obtained would assist AECB staff in assessing licencing assumptions concerning pump and piping behaviour during loss-of-coolant, or similar accidents.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$15K	$12K	$25K	$50K	$50K	$152K

Project Manager: A. Omar
Category: 1
Proponent: SED/CQAD
Evaluator: B. Jarman/J.K. Khosla
Review Panel: No

86.1.10 Fuel Element Susceptibility to Bowing in Dryout Conditions

It is proposed to conduct an experimental investigation of the susceptibility of fuel elements to bowing if operated in conditions of partial dryout. The study would focus on the behaviour of a 'trefoil' under representative reactor conditions.

A new criterion has been proposed by licensees for regional overpower trip system design which would permit operation of fuel elements in dryout at a power level approximately 5% above that at the onset of intermittent dryout. Current industry plans for supporting research involve an investigation of the consequences of a specific bowing shape. This proposed project would first demonstrate whether bowing could occur and, if so, under what conditions and with what resulting shape. Such information is essential in assessing the dryout and post-dryout behaviour to fuel bundles.

The results of this project would assist AECB staff in deciding on the acceptability of the criterion proposed by licensees. The information obtained would also add to the state-of-knowledge in this field.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$65K			$65K

Project Manager: A. Omar
Category: 3

Proponent: SED
Evaluator: C.B. Parsons/A.M.M. Aly
Review Panel: No

86.1.11 Molten Fuel/Water Interaction - Load Quantification

It is proposed to experimentally determine the loads generated in a closed tank of water by the rapid addition of material simulating molten fuel. Determination of energy conversion factors and the form of the energy conversion would be carried out. This proposed contract would follow, and would depend on the results of, a current contract examining fuel moderator interaction (84.1.30).

An uncooled fuel channel could rupture and deposit molten fuel, steam and gas into the moderator. This would result in a rapid transfer of energy to the moderator and could generate violent shock and pressure waves.

The results of the project would be used in assessing licensee claims concerning the integrity of the reactor core under accident conditions.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$100K	$50K		$150K

Project Manager: A. Omar
Category: 3

Proponent: CQAD
Evaluator: B. Jarman/V. Tang
Review Panel: No

86.1.12 Hydrogen Burn Characteristics of Vented Enclosures

It is proposed to fund experimental work on a vented enclosure which has similar volume, volume-to-surface area ratio, volume-to-vent area ratio and obstacle configuration as a CANDU calandria. The project would

determine hydrogen, oxygen and helium mixture ratios which in the event of ignition of the mixture would (a) prevent effective venting and (b) allow detonation of the mixture.

The safety analyses of hydrogen burning in calandria are based on empirical relationships. They assume that effective venting occurs and that no detonation occurs. Recent results from research have cast doubts on the validity of these assumptions. Therefore, work is required which examines the limits of validity of the two assumptions.

The results of the project would be used in the assessment of the continued acceptance of safety analysis assumptions of adequate venting and no detonation in hydrogen burns in a calandria.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K			$60K

Project Manager: D.J. Martin
Category: 3
Proponent: SED
Evaluator: K.R. Shultz
Review Panel: No

86.1.13 Ice Plugging of Pipes Using Liquid Nitrogen

It is proposed to conduct a critical review of information on the use of liquid nitrogen freezing of large-diameter ferritic piping, and to assess the risks associated with its proposed routine use on CANDU piping. The review would examine both jacket freezing and liquid nitrogen injection freezing.

Licensees use ice plugging technique regularly on small-diameter piping and propose to use it on large diameter piping. The work being proposed is intended to address AECB staff concerns regarding the short- and long-term effects of freezing on piping integrity.

The outcome of this project would be used to identify and assess the conditions under which ice plugging may be used on reactor piping.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K			$25K

Project Manager: A. Omar
Category: 2
Proponent: CQAD
Evaluator: B. Jarman
Review Panel: No

86.1.14 Survey of Software Configuration Control Methods

A project is proposed which would survey presently available software configuration control methods and assess which of these techniques are applicable, and to what extent, to configuration control of software in

nuclear power plants during the development, commissioning and operational phases. This proposal would proceed only after an evaluation of a current project on computer software quality assurance (84.1.17).

The use of software in nuclear power stations is increasing, mainly due to the introduction of computer control for safety systems. This increases the requirements for systematic configuration control due to the use of similar software in different power plants. Because use of improperly configured software (e.g. use of a wrong version for a certain routine) could adversely impact on safety, the AECB needs to be aware of the relative merits of individual methods, including the most recent developments.

The results of the study would be used as an input in assessing licensees' submissions on configuration control of safety and safety-related software.

Past	FY 85/86	FY 86/87 $20K	FY 87/88	Future	Total $20K

Project Manager: D.E. Connelly
Category: 2
Proponent: RRB
Evaluator: D.E. Connelly/D. Scrimger
Review Panel: Yes

86.1.15 Plant Air Quality following Accidental Radioactive Releases

It is proposed to perform a literature survey to determine the feasibility of calculating reliable estimates of plant air quality for accidental airborne releases of radioactive material. The contractor would also be asked to recommend appropriate methods for use in deriving such estimates. Specific topics relevant to air quality would include: building wake effects, ventilation and filtering.

In the assessment of air quality following postulated airborne releases of radioactive material, further information is required on effects which could decrease the quality of air under such conditions by, for example, inverting flows in ventilation systems, or by causing localized high concentrations in such areas as the ECC sump.

The results of this project would be used in determining whether reliable estimates can be made of plant air quality for accident conditions, specifically in the evaluation of control room habitability and the appropriateness of assembly areas and evacuation routes. If it is decided that such estimates can be made, further work would be proposed.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K			$30K

Project Manager: D.J. Martin
Category: 1

Proponent: SED
Evaluator: L. Truong
Review Panel: No

86.1.16 Dose Calculations under Transient Conditions

It is proposed to fund a contract to calculate, for a specific reactor site, the individual and population doses for the spectrum of release scenarios defined in the reactor Safety Report. The principal variables of interest are: source release characteristics, weather conditions, and population distribution. It is also proposed to perform sensitivity studies on the model used.

Historically, dose calculations for accidental airborne releases at reactor sites use simple and overly-conservative assumptions such as steady-state release, most severe weather conditions, and fixed receptor location. Information is required with which to calculate more realistic estimates of dose.

The results of the project would be used in the assessment of licensee submissions on accident conditions involving airborne releases, and in gaining experience with previously-recommended "default" weather scenarios. The results of the sensitivity studies will be used to estimate bounding values of model parameters which are expected to be treated probabilistically in licensee submissions on Darlington NGS.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$35K			$35K

Project Manager: D.J. Martin
Category: 3

Proponent: SED
Evaluator: L. Truong
Review Panel: No

86.1.18 International Piping Integrity Research Group

It is proposed to join an International Piping Integrity Research Group. This group, organized by the U.S. Nuclear Regulatory Commission (USNRC), will examine the fracture behaviour of large piping systems. The proposed program by the USNRC will include: fracture tests done on approximately 60 large-diameter pipes, of which about one third are directly relevant to CANDU; material tests to establish a data base for fracture analysis; assessment of the efficacy of fracture calculations; review of degraded piping; and review of the state-of-the-art analytical and experimental developments.

There is a need to develop and verify the technology to justify: using analytical assessments to disposition piping defects and prescribe

inspection frequencies for them; permitting leak-before-break concepts in lieu of mechanical protection for hypothetical pipe ruptures; and current procedures for response to primary heat transport system leaks.

The results would be used to support, or change, the licensing criteria for protection against pipe rupture, to define in-service inspection frequencies, to develop rules for reactor shutdown after leaks have been detected.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$280K	$280K	$280K	$840K

Project Manager: A. Omar
Category: 1

Proponent: CQAD
Evaluator: B. Jarman/J.K. Pereira
Review Panel: No

86.1.19 Microcomputer Software for Heat Transfer Prediction

It is proposed to produce a microcomputer-based method suitable for predicting heat transfer conditions encountered during postulated accident scenarios in CANDU reactors. The proposed software package would incorporate up-to-date information in a simple and user-friendly format.

Various correlations describing the heat transfer processes are found in current licensing codes. There are uncertainties relating to the choice of correlations since they depend on several parameters such as geometry and flow regime. To assist in the analysis of such systems there is a need for a simple and inexpensive tool by which the effect of new correlations on the heat transfer predictions can be examined without running the more complex computer codes.

The resulting software package would be used in the assessment of safety submissions for postulated accident scenarios such as loss of regulation and loss-of-flow events. In particular it would be used to check the heat transfer prediction of the more complex computer codes used in licensing calculations.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K			$30K

Project Manager: A. Omar
Category: 1

Proponent: SED
Evaluator: Q.S. Truong
Review Panel: No

3. Uranium Mines and Mills

85.3.6 Physical Characteristics and Solubility of Airborne Long-Lived Dust in Uranium Producing and Manufacturing Facilities

It is proposed to determine experimentally the size distribution, the activity distribution and the solubility of airborne uranium-bearing aerosols in all Canadian uranium mines and mills.

This work is proposed to quantify the hazard presented by airborne radioactive long-lived materials in the concerned facilities. The parameters (size distribution, activity distribution, radionuclide composition and dissolution rate in simulated lung fluid) which are necessary to calculate the committed effective dose equivalent from exposure data must be determined in order to evaluate quantitatively this specific radiation hazard.

It is anticipated that this study will indicate the magnitude of the risk of long-lived dust in uranium producing and manufacturing industries. It will also provide supporting information for any forthcoming regulation on long-lived dust and will facilitate interpretation of bioassay data for the purpose of radiation protection of the workers at these facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$40K		$100K

Project Manager: K.P. Ho
Category: 1

Proponent: UMD
Evaluator: B. Smart (UMD), F. Horvath (RPD)
Review Panel: Yes

85.3.10 Determination of Radon and Thoron Fluxes in Uranium Mines (Ontario)

It is proposed to measure the flux of radon and thoron gases emitted per unit surface area of stopes, airways and passageways of an underground uranium mine.

The AECB has recently completed a research project (84.3.4) aimed at developing a computer model of underground mine ventilation networks. That model is made up of two parts. The first part of the model is used to determine the patterns of air circulation throughout the mine. The second part is designed to predict the concentrations of short-lived airborne radionuclides at given places of the ventilation network, for radiation protection purposes. The accuracy of those predictions depends on the quality of the information available on the characteristics of the sources of radon and thoron gases.

It is anticipated that systematic and accurate measurement of the characteristics of radon and thoron sources will enable the Board to use the computer ventilation model to its full capabilities, and to carry out studies and verifications required by the Uranium Mine Division.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$70K	$10K		$80K

Project Manager: P.J. Duport
Category: 1

Proponent: UMD
Evaluator: D. Corkill (UMD)
Review Panel: No

85.3.11 Determination of Radon and Thoron Fluxes in Uranium Mines (Saskatchewan)

It is proposed to measure the flux of radon and thoron gases emitted per unit surface area of stopes, airways and passageways of an underground uranium mine.

The AECB has recently completed a research project (84.3.4) aimed at developing a computer model of underground mine ventilation networks. That model is made up of two parts. The first part of the model is used to determine the patterns of air circulation throughout the mine. The second part is designed to predict the level of short-lived airborne radionuclides at given places of the ventilation network, for radiation protection purposes. The accuracy of those predictions depends on the quality of the information available on the characteristics of the sources of radon and thoron gases.

It is anticipated that systematic and accurate measurement of the characteristics of radon and thoron sources will enable the Board to use the computer ventilation model to its full capabilities, and to carry out studies and verifications required by the Uranium Mine Division.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$45K	$13K		$58K

Project Manager: P.J. Duport
Category: 1

Proponent: UMD
Evaluator: D. Corkill (UMD)
Review Panel: No

85.3.13 Characterization of Long-Lived Dust at a Saskatchewan Mine-Mill Facility

It is proposed to determine experimentally, using reference-type cascade impactors, the size distribution, activity distribution and radionuclide composition of airborne long-lived dust at a Saskatchewan uranium producing facility, and to compare, in the field, the performance of several aerosol sampling instruments. This is a joint AECB-EMR project. The work will be carried out by EMR, as part of a larger project planned for this facility.

This project is proposed because, in order to determine the adequacy of current practices used for evaluating the radiological and chemical risks to individuals exposed to airborne particulate material containing uranium and its decay products, it is necessary to know the physical

parameters that govern their inhalation, as well as their deposition in, and removal from, the lung. It is also necessary to compare the information given by every type of instrument used in the field which is used to determine workers' exposure to airborne long-lived dust.

It is anticipated that the measured particle size distribution, activity distribution and radionuclide composition will make it possible to determine the ALI and DAC specific to the considered site. The field comparison between all the measurements of concentrations of long-lived dust in the air, taken with a variety of instruments, or the individual exposures resulting from such concentrations and the measurements obtained from a reference calibrated instrument will allow the determination of a reliable standard measurement method.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$6K	$7K			$13K

Project Manager: P.J. Duport
Category: 1

Proponent: UMD, J. Bigu (EMR)
Evaluator: S.H. Ching (RPD), A.B. Dory (UMD)
Review Panel: No

86.3.1 Field Intercomparison of Instruments Used in the Determination of Size Distribution of Airborne Particles in Canadian Uranium Mines and Mills

It is proposed to perform field intercomparisons of instruments used to determine the size distribution of airborne particulate matter in all Canadian uranium mines and mills. Dust sampling instruments currently used by licensees for measuring uranium-bearing dust concentrations in the air will be tested against, and compared to, reference cascade impactors. Small-size personal cascade impactors will also be tested. The operating costs of current samplers and personal cascade impactors will be evaluated.

This project is proposed because, in keeping with the recommendations of ICRP 30, the AECB is considering the use of a combined formula for calculating the Committed Effective Dose Equivalent received by uranium workers. The combined formula expresses exposure as the sum of the ratios of the exposures to each specific radiation hazard (gamma, radon progeny, thoron progeny, long-lived dust) to their respective annual limit of exposure or their annual limit on intake. The annual limit on intake for radioactive aerosols is, among other factors, a function of the particle size. It is therefore necessary to know the size distribution of the radioactive dust of concern to determine such parameters as ALI, DAC or Committed Effective Dose Equivalent. However, currently used air samplers are designed to measure air concentrations of "respirable dust" when the notion of "respirable dust" does not apply to radioactive aerosols: every particle that enters the body contributes to the Committed Effective Dose Equivalent. Consequently, it is necessary to determine what uncertainties routine dust samplers introduce in the measurement of exposure to radioactive dust.

It is anticipated that the results of this study will indicate how the dust measurements obtained from currently used instruments, and from a personal cascade impactor, compare with measurements obtained from reference instruments. The influence of the size distribution of dust on instruments used routinely will be determined. This will assist the AECB in drafting guidelines for monitoring techniques and in evaluating codes of practice submitted by licensees.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$20K		$80K

Project Manager: K.P. Ho
Category: 3

Proponent: UMD
Evaluator: R. McCabe (UMD)
Review Panel: No

86.3.2 Calibration of Wire Screen Collectors Used in the Measurement of Unattached Fraction of Radon and Thoron Progeny in Air

It is proposed to calibrate experimentally a variety of wire screen aerosol collectors for measuring the unattached fraction of radon and thoron progeny in air. In addition, the theory and the semi-empirical laws governing aerosol collection and alpha counting characteristics on wire screen collectors will be given.

This project is proposed because the complete deposition of the unattached fraction of radon and thoron progeny in the respiratory tract delivers 10 to 20 times more energy per unit mass of tissue than the attached fraction present in the atmosphere. The unattached fraction of radon and thoron daughters is highly variable, ranging from a few percent in diesel-powered areas of uranium mines, to more than 40% in non-mechanized areas and surface installations. Consequently, a complete evaluation of the radiological hazard presented by airborne radioactivity requires the knowledge of the unattached fraction. Wire screen aerosol collectors are the most convenient tools for measuring the unattached fraction; however, the characteristics of their collection efficiency and counting geometry have not been thoroughly investigated.

It is anticipated that the results of the study will fill a gap in knowledge regarding the accuracy of a crucial parameter in the measurement of ultrafine radioactive aerosols. They will also allow the Board staff to interpret more accurately atmospheric radioactivity measurements taken in uranium producing facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$30K		$90K

Project Manager: P.J. Duport
Category: 1

Proponent: HRS
Evaluator: RPD
Review Panel: No

86.3.3 Development of a Dosimetry Database for Atomic Radiation Workers in Canada

It is proposed to develop a dosimetry database for Atomic Radiation Workers in Canada. The contractor will design and produce an operational database that contains all necessary information and analytical procedures to permit the AECB to perform statistical and time series analyses of exposure and dose records using the AECB computer system.

This project is being proposed because there has been very little work done to date with respect to analyses of these exposure and dose data. Moreover, exposure and dose data received from the licensees by the AECB are in printed form, a form which is not easily amenable to trend analyses or calculation of statistical parameters. Exposure and dose information in the National Dose Registry is oriented toward individual records with little characterizing information, thus of very little use in identifying and analyzing groups of workers by sector within the nuclear industry, by specific nuclear facility, or by licensee. There will, therefore, be no duplication between the uses of this database and that of the National Dose Registry.

It is anticipated that analyses by AECB staff of the records to be included in the computer database for such workers will enable the AECB to have up-to-date information on the radiological conditions that prevail at the various nuclear facilities and for the various types of occupational groups. Distributions of exposures and doses by occupational group, nuclear facility type, etc., as well as individual and collective long-term exposure and dose trends should become known by these means, along with some information required for further reducing the radiation risks to these groups. The part of the database consisting of the exposure and dose records of uranium mine workers will likely be the first to be analyzed using this computer system.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K	$40K		$90K

Project Manager: K.P. Ho
Category: 2
Proponent: HRS, UMD
Evaluator: D. Corkill (UMD), RPD
Review Panel: No

4. Other Fuel Cycle Facilities

84.4.1 Demonstration of the Feasibility of Directly Dating Quartz

Using samples of quartz from rocks of known age it is proposed to examine the feasibility of directly dating the quartz using a technique involving electron spin resonance.

This study is proposed because, in selecting the site for any nuclear facility, it is important to know whether or not the earth's crust in the vicinity of the proposed site is relatively stable. The presence of earthquakes is an obvious indicator of instability. However, some seismically active areas have been known to be quiescent for as long as 2000 years before major seismic activity was renewed yet, in Canada, earthquake records go back a maximum of only 450 years. To help obtain a more accurate estimate of the tectonic conditions, the minimum age of the youngest fault movement should be known.

If the results of using electron-spin resonance to date quartz are positive then the intention would be to indicate to licensees, in the form of guidelines, that, where appropriate, fault-filling quartz be dated.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$15K		$50K			$65K

Project Manager: J.L. Wallach
Category: 1

Proponent: SSS
Evaluator: J.L. Wallach/P. Conlon
Review Panel: Yes

84.4.10 Determination of Concentration Factors - Game Animals

It is proposed to complete the determination of concentration factors in the soil/forage/moose pathway for selected radionuclides of the uranium and thorium decay chains.

As moose form part of the diet of some people in the Elliot Lake region, there is a need to know the concentration factors for this pathway. Currently, concentration factors for this food/animal pathway are not available and there is no information as to the significance of the contribution of this pathway to dose.

The data and concentration factors, as well as the related information gained from this project, will be used in evaluating the validity and reliability of derived release limit estimations or any other submissions to the AECB where doses to humans have been estimated from pathways analysis.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$35K	$20K			$55K

Project Manager: R.J. Maloney
Category: 1

Proponent:
Evaluator: C. Letourneau
Review Panel: No

84.4.17 Transfer of Radionuclides from Food to Human Milk

It is proposed to determine the concentration factors for radium, thorium, strontium and iodine in the pathway from food to human milk.

At present, concentration factors for this pathway are practically non-existent. Those that are used in license submissions, such as in derived release calculations, have been produced from only a small set of measurements. The information gathered by this project will aid in determining the validity of currently used concentration factors and provide an indication of their reliability.

These data and concentration factors, as well as the information gained from doing this project, will be used in evaluating the validity and reliability of derived release limit estimations or any other submissions to the AECB where doses to humans have been estimated using this pathway.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$10K	$90K			$100K

Project Manager: R.J. Maloney
Category: 2

Proponent: RPD (C. Letourneau)
Evaluator: RPD
Review Panel: Yes

85.4.4 A Review of Financial Assurance Mechanisms

A project is proposed which would survey currently available methods for providing financial assurance relating to the costs of decommissioning nuclear facilities.

The AECB wishes to ensure that funds are available to pay the costs of decommissioning nuclear facilities. As yet, it is not clear which method or combination of methods is appropriate for the various nuclear facilities.

The results of the study would provide guidance to the AECB in developing appropriate requirements for financial assurance mechanisms which are tailored to specific nuclear facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$20K			$20K

Project Manager: D.E. Connelly
Category: 3

Proponent: WMD
Evaluator: T. Viglasky/M.C. White
Review Panel: No

85.4.10 Geological Evidence of Seismicity - Charlevoix

It is proposed that field investigations be undertaken in the Charlevoix, Quebec, earthquake area to look for, document, and evaluate the kinds of land forms, structures in unconsolidated sediments, and changes in sedimentary layers which have been identified elsewhere and have been interpreted as being generically associated with earthquakes.

This study is proposed because the Charlevoix area has been the site of some of eastern Canada's largest earthquakes, yet no studies have been conducted there to look for geological evidence of these events. Therefore, this study, if successful, will provide geological information to supplement the existing seismic data and enable evaluating the nature and periodicity of both historic and pre-historic earthquakes. Because of the coexistence of geologic and seismic data, it would also provide information for estimating seismic risk in areas being considered for nuclear facilities. The study which would cost a total of $175K over the next three years would be carried out in conjunction with the Geological Survey of Canada and the Earth Physics Branch.

The results of this study are intended to be used both in the formulation of guidelines and for evaluating information from licensees regarding estimates of seismic risk to nuclear facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$41K	$15K	$40K	$30K		$126K

Project Manager: J.L. Wallach

Category: 1

Proponent: J-Y Chagnon, J. Locat (Laval University)/J.L. Wallach

Evaluator: J.L. Wallach/Z. Domaratzki

Review Panel: Yes

85.4.15 Transfer Parameters: Feed-Beef Pathway

It is proposed to determine the transfer parameters for selected radionuclides in the ingestion to beef pathway.

Transfer parameters for the feed to beef pathway either do not exist or have not been determined from statistically significant numbers of samples. Because of this lack of information, dose calculations are made using default values that in some cases are based on a single measurement, or are the mean results that range over two orders of magnitude.

The data and transfer parameters, as well as the related information gained from the project, would be used in evaluating the validity and reliability of derived release limit estimations or any other submissions to the AECB where doses to humans have been estimated from pathways analysis.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K			$40K

Project Manager: R.J. Maloney
Category: 1

Proponent: RPD
Evaluator: RPD
Review Panel: Yes

86.4.1 Stress Measurements in Southern Ontario - Phase 3

It is proposed to continue the stress measurement program in the Roblindale Quarry by, among other things, measuring the three-dimensional state-of-stress at fairly shallow depths as well as at a depth of one to two kilometres.

This study, which would continue to be carried out with Ontario Hydro, is proposed in order to gather further information relevant to assessing seismic risk in eastern Canada. The information from this and other related studies, such as that being undertaken in the Charlevoix seismic zone, are needed in order to acquire a reliable data base (other than seismic data themselves) and a far more complete understanding of conditions and characteristics which, respectively, may lead to, and result from, earthquake activity.

It is anticipated that the results of this, and related studies, will eventually be used both for establishing guidelines, and evaluating claims made by licensees, germane to seismic risk.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$20K	$20K	$30K	$15K	$15K	$100K

Project Manager: J.L. Wallach
Category: 1

Proponent: D. McKay (Ontario Hydro)/J.L. Wallach
Evaluator: J.L. Wallach/Z. Domaratzki
Review Panel: Yes

86.4.2 Neotectonic Conditions in Eastern Canada - Phase I

It is proposed to participate in, and contribute to, a Federal-Provincial Working Group, the formation of which is being planned to address geologic conditions and, ultimately, the issue of seismic risk in southern Ontario. The group will comprise the Geological Survey of Canada, the Ontario Geological Survey and Ontario Hydro in addition to the AECB. The program to be undertaken by this group is envisaged to last on the order of 5 years and to cost an estimated $2 million. The first study to be commissioned would be a review and analysis of all available geological information dealing with the tectonic setting of southern Ontario and adjacent areas of Canada and the United States.

This program, and AECB participation in it, are proposed because, to date, the assessment of seismic risk has relied solely upon documenting and evaluating historical and current seismic data. This approach has limited value because it is based on the assumption that future earthquakes will occur in areas of past events. Therefore, if a nuclear facility is planned for an area in which earthquakes have not been documented, it is conceivable that the probability of occurrence of a major, disastrous earthquake will be underestimated. Consequently, the design of a nuclear facility to withstand such an earthquake may be inadequate.

It is anticipated that the results of this entire program will provide the AECB with appropriate information for establishing a regulatory position addressing all aspects of seismic risk. The results are also anticipated to be useful in assessing the thoroughness of work undertaken, as well as claims made, by licensees in this particular study area.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$20K	$100K	$280K	$400K

Project Manager: J.L. Wallach

Category: 2

Proponent: O. White (Ontario Geological Survey)/J.L. Wallach
Evaluator: J.L. Wallach/Z. Domaratzki
Review Panel: Yes

86.4.3 Determination of Transfer Parameters: Feed-Pork Pathway

It is proposed to determine transfer parameters in the feed-pork pathway for selected radionuclides.

This project has been proposed because data for calculating transfer parameters for the feed-pork pathway are non-existent.

The data and transfer parameters obtained from this project would be used by AECB staff in evaluating the significance of the feed-pork pathway in the calculation of potential doses to humans.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$20K	$30K		$50K

Project Manager: R.J. Maloney
Category: 2

Proponent: RPD
Evaluator: M. Measures
Review Panel: Yes

86.4.4 Transfer Parameters: Inhaled Air-Cow Milk Pathway

It is proposed to undertake a laboratory study to determine the uptake of selected radionuclides in cow milk through the inhalation pathway.

This project is being proposed because at present the data necessary to calculate the transfer parameters for the air to milk pathway in cows are non-existent.

The results obtained of this project would allow AECB staff to determine the significance of the bovine air-milk pathway in dose calculations such as those made in deriving release limits.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$55K			$55K

Project Manager: R.J. Maloney
Category: 3
Proponent: RPD
Evaluator: M. Measures
Review Panel: Yes

86.4.5 Transfer Parameters - Non-Domesticated Animals

It is proposed to determine the radionuclide content of the tissues of non-domesticated animals hunted and trapped in the Serpent River Drainage Basin. Non-domesticated animals shown to be part of the diet of people living in the Serpent River Basin by a previous project (85.4.12) will be selected for this study.

Currently, transfer parameters are not available for these food-animal pathways. When transfer parameters are required, values obtained for domestic animals are sometimes used. There is little information on the significance of the transfer parameters for these pathways in dose calculations.

Transfer parameters and information gained from this project would be used in evaluating the validity and reliability of derived release limit calculations or any other pathways analysis used in calculating dose to humans.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K			$40K

Project Manager: R.J. Maloney
Category: 2
Proponent: RPD
Evaluator: C. Letourneau
Review Panel: Yes

86.4.6 Effect of Soil on Radionuclides in Plants: Literature Survey

It is proposed to conduct a literature survey to determine the effect of soil texture, moisture content, pH and nutritional status (defined as soil nitrogen, phosphorus and potassium content) on the uptake of Pb-210 and Th-232 by plants.

The uptake of radionuclides by plants is affected by the chemical and physical conditions found in the soil and these conditions will vary from one location to another. At present the extent and availability of information concerning the degree to which these conditions affect the uptake of certain radionuclides by plants is not known. AECB staff are therefore not in a position to evaluate the suitability of some default values used for plant radionuclide uptake in calculations of dose to members of the public.

The results of this work would assist AECB staff in the assessment of the suitability of default values for Pb-210 and Th-232 used in dose calculations such as in the derivation of release limits and dose assessments.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$15K			$15K

Project Manager: R.J. Maloney
Category: 3
Proponent: RPD
Evaluator: C. Letourneau
Review Panel: Yes

86.4.7 Survey of Data on the Radionuclide Content of Fish

It is proposed to survey and evaluate all available data on the radionuclide content of fish taken from waters in the vicinity of uranium mines and mills.

Much information exists concerning the radionuclide content of fish and the transfer of radionuclides into fish. However, as most of the data are presented in tabular form or in review articles it is difficult to judge the validity of the information when presented in these forms. There is a need to evaluate the information as originally presented so that a reliable and accurate database may be established.

The results of the project would be used in dose calculations, pathways analyses or derivations of release limits where accurate and reliable data for assessing the transfer of radionuclides to fish are required.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$20K			$20K

Project Manager: R.J. Maloney
Category: 1
Proponent: WMD
Evaluator: W. Whitehead
Review Panel: Yes

86.4.8 Suspended Solids in Liquid Effluents: Literature Survey

It is proposed to conduct a survey of available literature to determine what investigations have been made concerning particulates and suspended solids in the liquid effluents of operating nuclear power reactors.

Particulates and suspended solids are an acknowledged portion of the liquid effluents at nuclear generating stations, but little is known about these materials or their environmental fate.

Information concerning the nature and environmental fate of solids and particulates in the liquid effluents of nuclear power stations would be of use to AECB staff in determining whether more specific guidelines are required in this area.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K			$25K

Project Manager: R.J. Maloney
Category: 1

Proponent: RPD
Evaluator: M. Measures
Review Panel: No

5. Waste Management

84.5.1 The Cost of Decommissioning Uranium Mill Tailings

It is proposed to estimate the initial and on-going costs of decommissioning uranium mill tailings and the costs associated with maintaining any institutional controls that may be required.

This study is proposed because, even in the absence of a truly "walk-away" situation, tailings should be decommissioned in a mannner which will not constitute an unacceptable risk to future generations. To ensure that the risk does not increase following the completion of decommissioning, institutional controls may be necessary to avoid intrusion and to provide remedial action.

A knowledge of the costs of decommissioning and perpetual care is needed to determine how much money should be set aside and to evaluate the financial impact of regulatory requirements. The information is also necessary to be able to verify or question with authority claims made by the licensees regarding costs.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$21K	$6K	$1K			$28K

Project Manager: J.L. Wallach
Category: 1

Proponent:
Evaluator: B. Zgola
Review Panel: No

84.5.5 Impact of Radiation on Containment in Waste Disposal

A project is under way to assess the effects of radiation on all components of the deep geological disposal system which are likely to be affected by radiation.

This is being done through a study of available data, and emphasis being placed on the near-field components: the waste-form, canisters, buffer and backfill materials and the host rock. Following the assessment of the effects, the likely impact of radiation on the effectiveness of a deep disposal system will be examined.

It is anticipated that the results of this study will be used in developing guidelines and evaluating submissions to the Board, most particularly those addressing the design of the deep geological repository and its contents.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$31K	$14K			$45K

Project Manager: J.L. Wallach
Category: 1
Proponent: WMD
Evaluator: P.J. Conlon
Review Panel: No

84.5.11 Waste Management Implications of Concentrating Slimes

It is proposed to evaluate the physical and chemical behaviour of tailings which remain after the coarse fraction has been removed for use as backfill underground.

This work is proposed because the remaining tailings contain an enhanced proportion of slimes and most of the original radium, and are relatively impervious to water flow. Because of these properties there is a need to know what the short- and long-term implications are for tailings management.

The results of this study should enable the AECB to determine whether or not, as a result of concentrating the slimes, additional licensing conditions should be imposed, both for the operational and post-operational stages of mill tailings management. The results should also enable AECB staff to assess the claims made by licensees regarding the implementation of this practice.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$18K	$6K	$3K			$27K

Project Manager: J.L. Wallach
Category: 1
Proponent:
Evaluator: B. Zgola/A.B. Dory
Review Panel: No

84.5.13 A Review of Subsurface Hydrogeologic Conditions

It is proposed to continue with the next phase of this project to review and interpet all available information on groundwater flow generated during studies relevant to the deep disposal of radioactive waste.

This study is a follow-up to the study entitled "A Review of Hydrogeology Research Techniques" and, together with that study, will provide information which will keep the AECB apprised of the most up-to-date information in the area of hydrogeology.

It is anticipated that this information will help AECB staff in evaluating the deep disposal program by providing independent information on groundwater conditions. It is also anticipated that the results would be useful in writing guidelines.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$43K	$32K			$75K

Project Manager: J.L. Wallach
Category: 1
Proponent: RRB
Evaluator: P.J. Conlon
Review Panel: No

84.5.14 Hydrogeological Factors to Be Addressed in Guidelines

It is proposed to continue this project on identifying those properties of groundwater and the conditions affecting groundwater flow which should be evaluated in determining the suitability of a site and region for the deep underground disposal of radioactive waste.

This study is intended to provide a perspective, independent of that held by AECB staff, which will ensure that AECB staff have not overlooked any relevant hydrogeological factors.

It is anticipated that this information will be used to modify existing guidelines or to write additional guidelines pertaining to the hydrogeological aspects of the deep disposal program.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$5K	$30K			$35K

Project Manager: J.L. Wallach
Category: 1
Proponent: SSS
Evaluator: WMD/RRB
Review Panel: Yes

84.5.15 Shallow Ground Disposal - Calculation of Dose

It is proposed to proceed with a detailed feasibility study of adapting a model identified in a previous survey project (84.5.4) to calculate the doses that could result from various combinations of waste in different conditions of shallow ground disposal.

No suitably flexible program package was readily available with which to assess the performance of shallow disposal facilities.

This work will result, if feasible, in an implementation plan to adapt the model identified in project 84.5.4 to AECB requirements. Project 86.5.5 will carry out this implementation plan allowing AECB staff to assess license applications relating to the shallow disposal of radioactive waste. The model will also be used in determining what wastes might be suitable for disposal in shallow ground facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$22K		$35K			$57K

Project Manager: D.E. Connelly
Category: 1
Proponent: WMD
Evaluator: K.P. Wagstaff/D.E. Connelly
Review Panel: Yes

.85.5.1 Inventory Methods for Radioactive Waste Packages - A Survey

This project will survey and evaluate methods currently used nationally and internationally in nuclear facilities to determine the inventories of radionuclides in waste packages destined either for storage or disposal.

This project has been proposed as part of an on-going effort to aid the AECB staff in their daily licensing activities by keeping their knowledge as current as possible.

The information gained by this project will be used by the AECB staff to assess present and proposed practices of waste package inventorying.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$5K	$7K			$12K

Project Manager: R.J. Maloney
Category: 1
Proponent: WMD
Evaluator: P.J. Conlon
Review Panel: No

85.5.3 Survey of Computer Codes for Flow and Contaminant Transport

It is proposed to select and develop a two-dimensional, finite-element computer code for the calculation of groundwater flow and radionuclide transport through saturated and unsaturated porous media as found in mine tailings management areas or shallow surface waste storage and disposal sites.

Commercially available finite-element computer codes analyzing seepage through earthworks are primarily designed for stress analysis. Modification of these codes for flow and contaminant transport introduces difficulties. In addition, the cost of performing sensitivity analyses on transient models is prohibitive. Thus there is a need to review and evaluate existing models and select one for modification and use on the HP-1000 computer.

At the present time AECB staff are reviewing three licensing submissions which involve the modelling of radionuclide migration. The model selected and developed under this project would enable the AECB staff to perform their own independent calculations and thus be in a much better position to assess the approaches and results contained in the submissions. In addition the model which is selected and developed could be used as one of the components of the models being developed in a concurrent project, "Shallow Ground Disposal - Calculation of Dose."

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$5K	$30K			$35K

Project Manager: D.E. Connelly
Category: 1
Proponent: SED
Evaluator: K. Asmis/D.E. Connelly
Review Panel: No

85.5.7 Movement of Radionuclides between Water and Sediments

It is proposed to identify and elucidate the most apparent mechanisms of radionuclide sedimentation and remobilization in the Serpent River surface water system and incorporate them into an existing model of the Region. This would be a joint project with the National Uranium Tailings Program at a total cost of $80K over two years.

To date little, if any, emphasis has been placed on the role of sediments in radionuclide transport through surface water systems. There are two main reasons for this. First, the complex interactions and mechanisms involved are not fully understood, and second, the field data required for elucidating the complex mechanisms are sparse.

By incorporating the mechanisms of water-sediment-radionuclide interactions into an existing model of the Serpent River drainage system, would enable Board staff to evaluate the significance of the role of sediments in deriving release limits and in calculating doses to humans resulting from the management of uranium mills tailings.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K			$60K

Project Manager: R.J. Maloney
Category: 1
Proponent: WMD
Evaluator: B. Zgola/R.M. Chatterjee
Review Panel: Yes

85.5.8 Verification, Validation, and QA for Waste Disposal Models

It is proposed to survey the latest developments in verification, validation and software quality assurance methods applied to modelling software. The survey would identify the best applicable methods for testing and assuring quality of nuclear waste disposal software modelling systems.

AECB staff will be required to assess licensee submissions concerning the predicted performance of existing and proposed nuclear waste disposal facilities. Some of these performance predictions will be generated by software modelling packages currently under development by industry and other government agencies. The validity of the modelling results is related directly to the effectiveness of the verification, validation and quality assurance methods used in model design and development.

The results of the survey will assist AECB staff in assessing the effectiveness of the verification, validation and quality assurance aspects of a particular model and hence the qualitative degree of confidence to be assigned to the model's predictions.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K			$25K

Project Manager: D.E. Connelly
Category: 1

Proponent: RRB/WMD
Evaluator: D.E. Connelly, K.P. Wagstaff
Review Panel: Yes

85.5.9 Optimization in the Decommissioning of Uranium Tailings

It is proposed to fund a project jointly with the National Uranium Tailings Programme. The project would survey the literature to determine optimization techniques which could be applied in the evaluation of decommissioning options for Canadian uranium mill tailings. For techniques which are identified to be so applicable, the project would also demonstrate precisely how each technique could be used in the evaluation of decommissioning options.

In the licensing process, the AECB requires optimization analyses to be performed, to ensure that exposures are as low as reasonably achievable (the ALARA principle). In relation to this process, the AECB requires information on techniques which may, in principle, be applied to the specific case of evaluating options for the decommissioning of uranium mill tailings.

The information obtained from the project would be used as input to the licensing process when evaluating licensee submissions relating to the decommissioning of uranium mill tailings.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K			$30K

Project Manager: D.J. Martin
Category: 1

Proponent: WMD
Evaluator: B. Zgola
Review Panel: No

86.5.1 Waste Management Implications of Concentrating Slimes - II

It is proposed to compile and review information on the management of uranium and non-uranium tailings in order to prepare a report suggesting methods for overcoming the problems of concentrating slimes identified in the first phase of this study (84.5.11).

Current plans call for backfilling uranium mines with the coarse fraction of tailings, leaving a residue of fines, or slimes. However, certain chemical, geological and mechanical problems arise from concentrating the slimes. The AECB needs to be apprised of any proven, or even well-conceived but as yet non-implemented, techniques for dealing with these problems.

It is anticipated that the results of this work will provide the AECB with a compiled source of information which can be used in evaluating operating and decommissioning proposals by licensees.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$28K	$25K			$53K

Project Manager: J.L. Wallach
Category: 1
Proponent: WMD/UMD
Evaluator: B. Zgola/A.B. Dory
Review Panel: No

86.5.2 State-of-Stress and Groundwater Flow

It is proposed to utilize existing boreholes at the Roblindale Quarry in order to monitor groundwater flow directions and rates in the underlying Precambrian granite.

This study is proposed in order for the AECB to acquire independent information on the flow of groundwater through fractures in plutonic rock. It is also being proposed to determine if the predominant flow direction is in any way related to the orientation of the ambient principal stresses at the quarry.

The results of this study would be used to evaluate information on groundwater flow which will be submitted to the AECB as part of the Concept Assessment phase of the Canadian Nuclear Fuel Waste Disposal Program.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$55K			$55K

Project Manager: J.L. Wallach
Category: 1
Proponent: D. McKay (Ontario Hydro)/SSS
Evaluator: J.L. Wallach
Review Panel: Yes

86.5.3 Performance of Engineered Barriers for Low-Level Wastes

It is proposed that a literature review be conducted to synthesize and interpret the information available on the performance of engineered barriers used in the disposal of low level wastes.

At the present time, simple assumptions about the waste form and surrounding barriers are often used in modelling and safety assessment studies. However, the consequences of various release mechanisms and exposure pathways are likely to be sensitive to variations in the properties of the engineered barriers. Of particular interest is the transport of water and radionuclides through the barriers and how this changes with time as a result of degradation under shallow burial conditions in representative regions of Canada.

It is anticipated that the results of the literature review and synthesis will be of use to AECB staff in decisions relating to the long-term performance of barriers in waste storage facilities, nuclear facilities undergoing decommissioning, and waste disposal facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$35K			$35K

Project Manager: J.L. Wallach
Category: 1
Proponent: WMD
Evaluator: K.P. Wagstaff
Review Panel: No

86.5.4 Methodology for Estimating Probabilities of Intrusion

It is proposed that a generic methodology be developed for estimating the probabilities of intrusion scenarios for different types of waste management facilities. The methodology would take into account inter alia burial depth, location, current and projected land-use patterns and facility design.

Inadvertent human intrusion is an issue that is raised when considering nuclear fuel waste disposal, low-level waste disposal and uranium tailings management, yet there is no consensus on how it should be addressed by either regulators or licensees.

It is anticipated that the results of the study would be used in giving guidance to licensees in conducting safety and performance assessments and in applying regulatory criteria. The study when factored into the licensing process for waste management facilities would serve to clarify the need for, and length of time required for, institutional controls and various types of land-use restrictions.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$20K			$20K

Project Manager: J.L. Wallach
Category: 2
Proponent: WMD
Evaluator: K.P. Wagstaff
Review Panel: No

86.5.5 Calculation of Dose from Shallow Ground Disposal

It is proposed to proceed with the implementation of a shallow ground disposal systems model built around a model identified in previous survey projects (84.5.4), but adapted to Canadian conditions and AECB requirements. The implementation plan to be followed, results from the preceding feasibility phase (84.5.15).

No suitably flexible program package appropriate for Canadian conditions was readily available with which to assess the performance of shallow disposal facilities.

This work will aid AECB staff in assessing licence applications relating to the shallow disposal of radioactive waste. The model will also be used in determining what wastes might be suitable for disposal in shallow ground facilities.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K	$25K		$65K

Project Manager: D.E. Connelly
Category: 2
Proponent: WMD
Evaluator: K. Wagstaff
Review Panel: Yes

86.5.7 Erosion of Surface and Near-Surface Disposal Facilities

It is proposed to evaluate available information on the erosion of naturally occurring, unconsolidated sediments in order to estimate the length of time that surficial and near-surface disposal facilities are likely to resist erosion and prevent the release of unacceptable concentrations of radioactive materials.

This study is proposed because, to date, certain licensees consider only uniform sheet erosion when estimating the length of time that a disposal facility will provide adequate containment of radioactive waste. However, because of the rapidity of some erosional processes relative to sheet erosion, such as gully formation, it is suspected that containment may not be maintained for as long a period of time as currently claimed by the licensees.

The results of this program will be used determining the acceptability of the approach currently adopted by the licensees regarding the erosion of surface and near-surface waste disposal facilities. The results may also indicate whether guidelines specifically addressing this phenomenon should be written.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K	$20K		$50K

Project Manager: J.L. Wallach
Category: 1
Proponent: SED
Evaluator: K.R. Shultz
Review Panel: No

6. Non Fuel Cycle Applications

86.6.1 To Develop a New Personal Neutron Dosimeter - Phase IV

It is proposed to provide funding for an ongoing project to develop and assess the bubble-damage polymer detector for neutron radiation. Funding for this project began in FY 83/84 and is anticipated to continue to the end of FY 86/87. The work to be funded in each of FY 85/86 and FY 86/87 will depend upon the findings of the previous year's research. This project is also receiving financial support from AECL (the contractor).

This work was initiated because no single existing neutron dosimeter is considered to be acceptable for monitoring neutron radiation in a variety of different environments where neutron radiation can occur (e.g., particle accelerators, reactors, etc.). The detector in this work shows promise because it is simple to use, compact, direct reading, very sensitive to neutron radiation, insensitive to gamma radiation and probably capable of detecting neutron radiation in the keV energy range and lower.

It is anticipated that this work will stimulate the development of a personal neutron dosimeter for radiation protection purposes that is superior to currently-used personal dosimeters.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$98K	$50K	$50K			$198K

Project Manager: E. Rabin
Category: 1

Proponent: H. Ing (AECL-CRNL), HRS
Evaluator: G. Poirier (RPD)
Review Panel: No

86.6.2 Doses from Portable Gauges

It is proposed to initiate a study to determine the doses received by operators of portable moisture-density gauges under various working conditions.

This study is proposed because the AECB has approximately 450 licensees for the use of portable moisture-density gauges. Currently, operators are not required to wear TLDs because the doses are normally low. However, depending upon the amount of use, the operator's procedures and the number of times the portable gauge has to be cleaned, the accumulated doses for individuals might become significant.

It is anticipated that the results of this study will provide information to the AECB to determine whether present operating procedures require changes and whether it is necessary for operators of portable gauges to wear TLDs.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K			$30K

Project Manager: K.P. Ho
Category: 1

Proponent: RTD
Evaluator: R. Brown (RTD)
Review Panel: No

86.6.3 Laboratory System for Alpha Particle Spectroscopy

It is proposed to develop an automated laboratory-based system for alpha particle spectroscopy that will be fully compatible with existing AECB laboratory equipment (including a Tennelec alpha detector, Tracor Northern Model 1706 pulse height analyzer, Canberra Series 85 multichannel analyzer (MCA), Nucleus alpha spectrometer, and other electronics). A sample changer and system controller will have to be designed, built and assembled.

This project is proposed because currently the AECB laboratory uses a single alpha detector and vacuum chamber for measurement of radium-226. The procedure involves the manual collecting and printing of the data, then the changing of the sample at the end of each measurement. Two to five samples can be processed per day. An automated system for sample changing and data collection would increase the number of samples the laboratory could handle by a factor of five, decrease possible operator error, and improve reproducibility. In addition, more effective use of the Canberra MCA would be possible.

It is anticipated that the system developed from this project will increase the capability of the laboratory to analyze samples for alpha-emitting radioisotopes.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K			$40K

Project Manager: E. Rabin
Category: 1

Proponent: CSLD
Evaluator: D.F. Sullivan, R.A. Washington (CSLD)
Review Panel: No

86.6.4 Radiation Doses to Technologists from Radiotherapy Treatment Procedures

It is proposed to measure and compare the radiation doses received by radiotherapy technologists during the performance of their duties at three different treatment machines at the Allan Blair Memorial Clinic, Saskatchewan Cancer Institute, Regina, Saskatchewan. The three types of

treatment machines are: cobalt-60 teletherapy unit, high energy linear accelerator (20 MeV), and low energy linear accelerator (4 MeV). Typical exposure values will be derived on a per-treatment basis for the more common treatment types, as well as on a weekly basis for each of the treatment machines included in this study.

This work is proposed because, in order to reduce the radiation exposure received by technologists in a radiotherapy department, it is necessary to identify the significant sources of exposure and their relative magnitudes. Also, the radiation exposures attributed to technologists may vary from machine to machine implying that there may be significant differences in exposure at the various machines. This study will measure the variations in exposures from machine to machine.

It is expected that the proposed research will provide information on the relative exposure received by technologists working on the different types of therapy machines. From this information, the AECB may be able to infer the mechanism by which the technologists receive the major part of their personal exposures. This information is essential in order to effect changes aimed at reducing personal radiation exposures, including the re-assignment of pregnant technologists to those duties where exposure is minimized as well as to develop new patient set-up techniques and protocols aimed at reducing the radiation exposure to the technologists.

Past	FY 85/86	FY 86/87 $10K	FY 87/88	Future	Total $10K

Project Manager: K.P. Ho

Proponent: M. Schmid (Allan Blair Memorial Clinic, Saskatchewan Cancer Institute, Regina), HRS

Category: 1

Evaluator: R. Brown (RTD)

Review Panel: No

86.6.5 Development of An Automated Method for Determination of Thorium in Soil Samples

It is proposed to develop an automated method, and the corresponding apparatus, for measuring the thorium content of soil samples. Such method and apparatus would complement the automated AECB laboratory equipment used for measuring thorium in liquids and aerosols.

In 1984, under another research contract, a method was developed for automating the determination of thorium in liquids and aerosols. The specialized equipment of the Board's laboratory was modified accordingly, and has performed routine thorium measurements satisfactorily since then. The report produced by the contractor mentioned that the apparatus could also be modified for automatic determination of thorium in soil samples. The number of soil samples to be analyzed can reach 200 samples in a year, and one sample, using manual techniques, can take about eight hours to analyze.

It is anticipated that the full automation of the AECB laboratory's thorium measurement apparatus will significantly reduce the time required to do thorium analyses and will free the staff for non-routine tasks. Automated measurement systems are also generally more reliable than those involving human intervention.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$10K			$10K

Project Manager: E. Rabin
Category: 1

Proponent: CSLD
Evaluator: S. Marcoux, R. Washington (CSLD)
Review Panel: No

7. Transportation

85.7.1 Verification of the Performance of Impact Limiting Fins: II

It is proposed to conduct a study to investigate the behaviour of impact limiting fins at a variety of impact speeds and impact angles. In addition, it is proposed to construct and test fins made of stainless steel.

Current designs of impact limiting fins are based on tests carried out at one impact velocity and one impact angle. Furthermore, the fins used in all previous tests have been of one material, mild steel; stainless steel has never been tested. This project will test the effectiveness of impact limiting fins made of mild steel and stainless steel at various impact velocities and impact angles.

The results of this project are to be used in writing guidelines for the construction of containers that use impact limiting fins. The information obtained on the stainless steel fins will be used in reviewing currently proposed designs on packages F294, F257 and F271.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$30K	$34K			$64K

Project Manager: R.J. Maloney
Category: 1

Proponent: RTD
Evaluator: D. Joseph
Review Panel: No

86.7.1 Doses to Transport Workers from Radioactive Materials

It is proposed to measure, over a defined period of time, the doses received by a selected subpopulation of transport workers. The measurements are to be correlated with the type of radioactive material

present in the appropriate shipments. Dose estimates are to be based on personal dosimetry measurements wherever possible; otherwise, the calculated doses will be based on realistic exposure models.

This work is proposed because there have been a number of incidents involving abnormally high radiation doses to workers during the transport of radioactive materials.

It is anticipated that this work will result in the identification of problem areas (with respect to radioactive materials) in the transportation industry and in improvements in the compliance and regulatory system. It will also contribute to the IAEA database on risk assessment with respect to transport workers.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: E. Rabin
Category: 1

Proponent: RTD
Evaluator: G.B. Johnston (RTD)
Review Panel: No

8. Health Physics

84.8.1 Epidemiological Study of Childhood Genetic Disorders

It is proposed to fund the ongoing epidemiological study of childhood genetic disorders in British Columbia. Genetic disorders among nearly 60,000 live birth cohorts from 1952 to 1982 and nearly 30,000 adults born before 1952 will be analyzed using the most recent classification codes.

This proposal is an update of an earlier British Columbia study which was used extensively by UNSCEAR for risk estimates for genetic disorders. Substantial amounts of data on childhood genetic disorders have been accumulated since the last study was conducted more than a decade ago.

The results of the study are expected to improve the risk estimates for radiation-induced genetic disorders.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$57K	$46K	$50K	$22K	$175K

Project Manager: V. Elaguppillai
Category: 1

Proponent: HRS
Evaluator: RPD
Review Panel: No

84.8.4 Ontario Miners Mortality Study - Phase III

It is proposed to fund the ongoing investigation of the cause of excess lung cancer among gold miners in Ontario and to update the mortality analysis for Ontario uranium miners for the period from 1981 to 1984 and for the gold miners from 1977 to 1984, in order to re-evaluate the risk of lung cancer per unit exposure.

This project is proposed because this is an extension of the Phase II study where excess lung cancer among gold miners and the influence of smoking on the incidence of lung cancer among uranium miners were investigated. The Phase II study recommended that the mortality analysis of gold miners should be extended from 1977 to 1984 to evaluate the impact of gold mining experience on the risk estimate for lung cancer among uranium miners.

It is anticipated that the results of the study will be used to improve the risk estimates for radiation-induced lung cancers. (A joint study with the Workers' Compensation Board of Ontario and Ontario Ministry of Labour on an equal cost-sharing basis.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$114K	$45K	$53K	$25K		$237K

Project Manager: V. Elaguppillai
Category: 1

Proponent: J. Muller (EX-OML), HRS
Evaluator: W.R. Bush (ACS), A.B. Dory (UMD), M. Measures (RPD)
Review Panel: No

84.8.5 Newfoundland Fluorspar Miners Mortality Study

It is proposed to fund the ongoing mortality analysis of Newfoundland fluorspar miners by extending the mortality analysis from 1978 to 1984 and by examining the smoking and dietary histories of the miners.

This study is proposed in order to extend the mortality analysis from 1978 to 1984, and to allow the use of revised exposure estimates to calculate the risk of lung cancer from radon daughter exposure. The revised risk estimates will also take smoking and dietary factors into account.

It is anticipated that the study will improve the risk estimates for lung cancer among miners exposed to radon daughters. (A joint study with Statistics Canada and the Department of National Health and Welfare.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$123K	$25K	$15K			$163K

Project Manager: V. Elaguppillai
Category: 1

Proponent: D. Wigle (NHW), HRS
Evaluator: W.R. Bush (ACS), M. Measures (RPD)
Review Panel: No

84.8.6 Ontario Miners 'Alive' Follow-Up Feasibility Study

It is proposed to fund the ongoing feasibility study of 'alive' follow-up of Ontario miners, by using available information from Canadian income tax data, Canada Pension Plan records and other suitable files.

This study is proposed because of the need to examine the uncertainties involved in 'alive' assumptions using various data files. In an occupational mortality study, names of persons in nominal rolls are usually matched against the names in the Mortality Data Base to ascertain deaths. Those who are not matched are usually assumed to be 'alive', and there may be some uncertainties in this assumption because some of these 'alive' persons might have died outside the country or been lost for follow-up purposes.

The results of the study are expected to improve the quality of death searches in occupational mortality studies and hence the risk estimates for radiation-induced cancers. (A joint study with Statistics Canada, Ontario Ministry of Labour and Workers' Compensation Board of Ontario.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$88K	$25K	$15K			$128K

Project Manager: V. Elaguppillai
Category: 1
Proponent: M. Smith (Statistics Canada), HRS
Evaluator: RPD
Review Panel: No

84.8.7 Epidemiology of Lung Cancer Mortality in Canadian Mining Communities

It is proposed to fund the ongoing case-control pilot study of lung cancer deaths in uranium and non-uranium mining towns across Canada in which lung cancer mortality has been shown to be significantly elevated.

The study is proposed in order to attempt to find out to what extent various factors in the home and the workplace were responsible for excess cancer among miners and other residents of mining communities.

It is anticipated that the results of this study will be used to improve risk estimates for radiation-induced lung cancers. (A joint study with Statistics Canada and Health and Welfare Canada.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$30K	$45K	$13K			$88K

Project Manager: P.J. Duport
Category: 1
Proponent: HRS
Evaluator: RPD
Review Panel: No

84.8.8 Study of Health Effects on Central Nervous System following In Utero Exposure to Ionizing Radiation

It is proposed to fund the ongoing full-scale study of the effects on the central nervous system of experimental animals following in utero exposure to ionizing radiation at different stages of gestation. This study is based on the recommendation of a feasibility study completed in FY 84/85.

This project is proposed because it is expected that an increasing number of young women will seek employment in the Canadian nuclear industry, where, in some cases, exposure of embryos or fetuses might occur. Very little information is available in the literature about the effect of in utero irradiation on the function and structure of the brain, and the proposed study will help in the understanding of the problem.

It is anticipated that the results of the study will be used to improve risk estimates for radiation-induced developmental defects.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$21K	$10K	$150K	$150K		$331K

Project Manager: V. Elaguppillai
Category: 1
Proponent: J. Muller (EX-OML), HRS
Evaluator: RPD
Review Panel: Yes

84.8.10 The Canadian National Dose Registry Study

It is proposed to provide funding for the ongoing project to conduct an epidemiological study of cancer mortality among some 300,000 Canadians occupationally exposed to low levels of ionizing radiation, by developing a suitable linkage between the Canadian National Dose Registry and the Canadian Mortality Data Base.

This study is intended to find out whether there is any excess cancer mortality among certain groups of workers, such as Nuclear Medicine Technicians and Radiographers, who have not been studied so far in sufficient detail. This study of 300,000 radiation workers is likely to provide further information towards a better understanding of the dose-response relationship for low doses of ionizing radiation.

It is anticipated that the results of this study will be used to verify risk estimates for radiation-induced cancer mortality. (A joint study with the Department of National Health and Welfare and Statistics Canada.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$55K	$65K	$95K	$80K	$30K	$325K

Project Manager: K.P. Ho
Category: 1
Proponent: P. Ashmore (NHW), HRS, M. Smith (Statistics Canada)
Evaluator: M. Measures (RPD)
Review Panel: No

84.8.11 Study of the Health Effects of Inhaled Uranium Ore Dust

It is proposed to provide funding for the ongoing project to study the health effects (cancer mortality and histological defects) on experimental animals exposed to different concentrations of long-lived radioactive dust, such as those encountered in the uranium mines in Ontario and Saskatchewan.

The study is proposed because Canadian uranium miners are occupationally exposed to long-lived dust (containing uranium, thorium and their long-lived daughters), and the contribution of this exposure to the incidence of cancer is not fully understood.

The results of this study will be used to interpret the health effects of long-lived dust on uranium miners and to develop regulatory guidelines for controlling exposures to long-lived radioactive dust.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$106K	$135K	$255K	$334K	$830K

Project Manager: P.J. Duport
Category: 1
Proponent: HRS
Evaluator: F. Horvath (RPD)
Review Panel: Yes

84.8.13 Epidemiological Study of Thyroid Cancer from I-131 Exposure

It is proposed to fund the ongoing epidemiological study of thyroid cancer among Canadians who were exposed to radioactive iodines during diagnostic examinations.

This project is proposed because risk estimates for radiation-induced thyroid cancer are largely based on the incidence among those exposed to X-radiation. There is some controversy as to whether or not the same doses of I-131 and X-radiation are equally effective for the induction of thyroid cancer. A pilot study, jointly funded by the Alberta Cancer Board and the AECB, has recommended a full-scale study at the national level to investigate the relative biological effectiveness of X-radiation and I-131.

The results of the study are expected to refine the risk estimates for radioiodine-induced thyroid cancers, and to determine whether or not equal (thyroid) doses of I-131 and X-radiation are equally effective in the induction of thyroid cancers. (A joint study with Alberta Cancer Board and NHW. The AECB share is one-third of the total cost.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$8K	$42K	$50K	$21K		$121K

Project Manager: V. Elaguppillai
Category: 1
Proponent: HRS, D.K. Myers (AECL-CRNL), T.W. Anderson (U.B.C.)
Evaluator: R.M. Chatterjee (RPD)
Review Panel: Yes

84.8.14 Measurement of the Thickness of Bronchial Epithelium

It is proposed to measure the depth of basal cells and the thickness of cilia and mucous layers covering the human epithelium of the tracheo-bronchial region to identify the cells that make up the epithelial walls, and to indicate their relative number in the cell population. Measurements of the various parameters will be made on biopsy and autopsy samples.

The study is expected to improve the accuracy of the various anatomical parameters used in lung dose calculations. Currently available data on the above anatomical parameters are based only on a single study which is known to have many uncertainties.

It is anticipated that the more accurately determined parameters obtained from this study will be used in the calculation of lung doses due to inhaled radon and thoron daughters and long-lived radioactive dust.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$55K		$115K

Project Manager: E. Rabin
Category: 1
Proponent: D.K. Myers (AECL-CRNL), HRS
Evaluator: F. Horvath (RPD)
Review Panel: No

84.8.15 Measurement of RBE for Tritium for Myeloid Leukemia

It is proposed to fund the ongoing laboratory experiment to measure the Relative Biological Effectiveness of tritium beta rays for the induction of myeloid leukemia in mice.

The study is proposed because of the concern as to whether or not a given dose of tritium beta rays is equally as effective as the same dose of chronic 200 kVp X-rays, acute 200 kVp X-rays and chronic Co-60 gamma rays for the induction of myeloid leukemia. A feasibility study completed in FY 84/85 has recommended a full-scale 5-year study on CBA/H mice.

It is anticipated that the results of the study are expected to improve the estimate of the quality factor (QF) for tritium beta rays. (A joint

study with AECL, Ontario Hydro, Hydro Quebec and NBEPC. The total cost of the study is 1.2 million dollars and the AECB share is $343K.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$8K	$23K	$51K	$64K	$197K	$343K

Project Manager: E. Rabin
Category: 1
Proponent: D.K. Myers (AECL-CRNL), HRS
Evaluator: R.M. Chatterjee (RPD)
Review Panel: Yes

85.8.2 Study of the Size Change of Inhaled Submicron Aerosols

It is proposed to continue to study, experimentally, the influence of the change of humidity and temperature on the size of inhaled radon and thoron progeny-bearing submicron aerosols as they pass from the open atmosphere through the respiratory system.

The dose delivered to the lung by inhaled radon or thoron progeny is strongly dependent upon the size of the particles. For an identical exposure to radon daughters, the dose to the lung doubles when the particle size decreases from 0.2 to 0.1 micrometre. Working level month-to-sievert conversion factors found in the literature (ICRP 32, NEA Experts Report on Dosimetry Aspects of Exposure to Radon and Thoron Daughter Products) are based on the assumption that the carrier aerosol has an activity median aerodynamic diameter (AMAD) of 0.15 to 0.3 micrometre. However, aerosol measurements in uranium mines indicate that radon daughter carrier aerosols generally have an AMAD of 0.1 micrometre or less. If the change in humidity and temperature which the aerosol encounters when it is inhaled does not affect its AMAD, higher exposure-to-dose conversion factors than those found in the literature should be used.

It is anticipated that the findings of this study will narrow the range of current exposure-to-dose conversion factors and hence will increase the accuracy of dose calculations.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$60K	$30K			$90K

Project Manager: P.J. Duport
Category: 1
Proponent: HRS
Evaluator: F. Horvath (RPD)
Review Panel: No

85.8.3 Comparison of the Rationale Used in Setting Occupational Limits for Radiation and Hazardous Chemical Substances

It is proposed to examine the rationale used in setting occupational standards for hazardous chemical substances and compare it with the rationale used for setting dose limits for ionizing radiation.

The study is proposed because there is a lack of comparative understanding of the rationale and the philosophy behind setting occupational standards for radiological carcinogens and hazardous chemical substances in the workplace.

It is anticipated that the results of the study will enable the AECB to judge whether or not the dose limits for ionizing radiation are based on a more or less sound rationale than the corresponding limits for hazardous chemical substances in the workplace.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$35K			$35K

Project Manager: E. Rabin
Category: 1

Proponent: ACRP, HRS
Evaluator: RPD
Review Panel: No

85.8.4 Epidemiological Study of Childhood Cancers Due to Parental Irradiation

It is proposed to fund the ongoing pilot study to examine the feasibility of a full-scale epidemiological study of radiation-induced childhood cancers among Canadians.

With the proposed changes in the dose limits for female atomic radiation workers, increasing numbers of young women are expected to seek employment in various activities where they might receive in utero exposures. Since a positive association between childhood cancers (mainly leukemia, thyroid and brain cancers) and low-level radiation has been reported in some countries, it is important to investigate this relationship among Canadian children and to determine to what extent other maternal factors, such as smoking, dietary pattern and intake of drugs during pregnancy, influence the relationship.

It is anticipated that the results of the pilot study will enable the AECB to determine the feasibility of a comprehensive case-control study. The comprehensive study is expected to result in the improvement of the risk estimates for radiation-induced cancers.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$25K	$41K			$66K

Project Manager: V. Elaguppillai
Category: 1

Proponent: V. Elaguppillai (HRS)
Evaluator: W.R. Bush (RPD)
Review Panel: Yes

85.8.6 Revision of Name Encoding Scheme (NYSIIS) for Use by Canadian Epidemiological Studies

It is proposed to continue the funding of this project which is examining the feasibility of revising the currently used computer code of name encoding scheme (NYSIIS) for Canadian names and phonetics using Ontario miners' mortality data.

A number of epidemiological studies of radiation-induced cancers reveal that 2-10% of mortality searches are lost because the currently used name encoding scheme developed by New York State (NYSIIS) is inadequate for certain Canadian surnames. A revised name encoding scheme might therefore be necessary to improve the accuracy of the mortality search.

The results of the study would be used to determine whether or not a revised name encoding scheme should be developed and used in all Canadian epidemiological studies of radiation-induced cancers.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$30K	$37K			$67K

Project Manager: K.P. Ho
Category: 1

Proponent: HRS, Statistics Canada
Evaluator: RPD
Review Panel: No

85.8.7 Epidemiological Study of Radiation-Induced Developmental Defects among Canadians

It is proposed to fund the pilot study to examine the feasibility of a full-scale epidemiological study of developmental defects among Canadians who received in utero irradiation. (Cancer is not considered to be a developmental defect.)

With the revision of dose limits for female atomic radiation workers increasing numbers of young women are expected to seek employment in the nuclear industry and in other activities where exposure of an embryo or fetus might occur. This exposure might result in increased incidence of radiation-induced developmental defects. The currently available risk estimate of 10^{-1} per Sv for developmental defects has a number of uncertainties associated with it and, therefore, further studies are needed. No comprehensive epidemiological study has ever been undertaken in Canada to obtain the additional information which would improve the risk estimates for radiation-induced developmental defects.

It is anticipated that the results of the study will enable the AECB to determine the feasibility of a full-scale study. Such a full-scale study, if it is feasible, is likely to result in the improvement of risk estimates for radiation-induced developmental defects.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K	$20K		$45K

Project Manager: V. Elaguppillai
Category: 1

Proponent: HRS
Evaluator: RPD
Review Panel: Yes

85.8.8 Comparison of the Techniques Used in Estimating Past Exposures to Radon Daughters in Canadian Mines

It is proposed to examine and compare the techniques used to evaluate past exposures to radon daughters in various Canadian uranium and non-uranium mines.

At present it is not known whether the techniques and assumptions used to estimate past exposures to radon daughters in the various Canadian mines, such as those in Newfoundland, Ontario and Saskatchewan, are similar to one another or different. As a result it is difficult to compare the risk estimates obtained from one study to another.

The results of the study would enable the AECB to compare and improve the risk estimates obtained from the various Canadian studies.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$45K			$45K

Project Manager: P.J. Duport
Category: 1

Proponent: ACRP, HRS
Evaluator: ACRP
Review Panel: No

85.8.11 Cost-Effectiveness of Reduction of Off-Site Dose

It is proposed to perform a cost-effectiveness analysis to examine alternate nuclear power plant effluent control technologies, their costs, and benefits in terms of reduced off-site dose.

This project is proposed because the AECB has been using a target of one percent of licensed emission limits for liquid and gaseous effluents for several years without verifying, through cost-effectiveness analysis, whether further measures to reduce radiation doses to persons off-site might be reasonably achievable.

It is anticipated that the information obtained from this study will help the Board decide whether additional measures to reduce off-site radiation doses should be required, and whether the current design and operating target (1%) is still appropriate in light of any technological advances that have occurred since this target was established.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: D.J. Martin
Category: 1

Proponent: J.W. Beare
Evaluator: RPD
Review Panel: Yes

85.8.12 Measurement of Absorbed Fraction of Ingested Uranium in Humans

It is proposed to determine the absorbed fraction (f_1) of ingested dietary uranium in humans, including those living in uranium mining communities, by measuring the content of uranium in their diet and in their fecal and urinary excretions.

The currently used annual limit on intake (ALI) for uranium by ingestion is derived using a value of 0.05 for the absorbed fraction (f_1) of ingested uranium. This fraction is known to have a number of uncertainties, and more measurements should be done to improve its accuracy.

The results of the study are expected to improve the value for f_1 and hence the estimate of the ALI for uranium.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$20K		$80K

Project Manager: K.P. Ho
Category: 3

Proponent: RPD
Evaluator: M. Measures, C. Pomroy (RPD)
Review Panel: No

85.8.15 A Feasibility Study on the Identification and Determination of Exposure Levels of Non-Radiological Carcinogenic Substances at Canadian Nuclear Facilities

It is proposed to continue the funding of this feasibility study which involves identifying and determining the occupational exposures to non-radiological substances at a number of Canadian nuclear facilities (e.g., Whiteshell Nuclear Research Establishment, Pickering Nuclear Generating Station, Eldorado Nuclear Ltd., Canadian General Electric Co.).

This study is being proposed because workers at Canadian nuclear facilities might be exposed to a number of non-radiological carcinogens. These carcinogens and their concentrations have not been accounted for in a number of epidemiological studies as potential factors in the induction of cancer among radiation workers. Before these carcinogens are properly accounted for in epidemiological studies, it is necessary to identify them and to determine their concentrations in the current radiation working environment. These concentrations may also provide the basis for historical estimates (of the concentrations of these carcinogens) relevant to the period of the epidemiological studies.

It is anticipated that the results of the study will demonstrate whether or not it is feasible to identify and to determine the concentrations of non-radiological substances at Canadian nuclear facilities. This should enable the AECB to carry out epidemiological studies on the potentiation of non-radiological substances as possible synergistic factors in the induction of cancer among workers in the current radiation working environment.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$14K	$32K			$46K

Project Manager: K.P. Ho

Proponent: HRS, J.L. Weeks/R.J. Hawkins (AECL-WNRE)

Category: 1

Evaluator: M. Measures (RPD)

Review Panel: No

85.8.16 Standardization of Individual Identifying Information for Health Record Keeping Methodology

It is proposed to continue the funding of the development and evaluation of a standard health record keeping methodology for employees of AECB licensees. This methodology will provide a standard for the collection of adequate individual identifying information to facilitate long-term follow-up of licensees' employees exposed to radiological and non-radiological hazardous agents for detection of possible health risks or delayed harm. The methodology will then be tested and evaluated by means of a pilot project, with a view to recommending procedures for the implementation, update, and maintenance of information related to individual identifiers.

This project is proposed because adequate personal identification captured and stored in a cost-effective retrievable form will facilitate future follow-up studies. Presently, it is often found during the linkage of data files in epidemiological studies (including AECB-sponsored studies, such as the Newfoundland Fluorspar Miners and the National Dose Registry workers) that inadequate individual identifying information is being maintained for current and past employees. The absence of complete and a sufficient number of identifiers makes it difficult and costly, or in many other cases impossible, to carry out long-term follow-up and record linkage studies for detection of health risks. The pilot project, for the testing and evaluation phase, is being proposed because it will ensure that the design, documentation and procedures developed are sufficient for the implementation and maintenance of a health record keeping system for AECB licensees who supply information on radiation doses to the National Dose Registry. The pilot project is expected to be carried out in collaboration with a licensee, likely Atomic Energy of Canada Limited.

It is anticipated that the results of the study will facilitate and encourage adequate on-going individual record keeping for the preparation of current and past employee nominal rolls. Since a standard record keeping method will make all licensees' files compatible, data analyses among the various files should not only be cheaper and more thorough, but also comparable. The standard method should facilitate periodical epidemiological studies, for example, as study populations age. It may also allow the study of synergisms among radiation and chemical agents, or among radiation and other factors (medical history, lifestyle, geographic location, etc.). The results may also form the basis of an unambiguous identification of the individual in conjunction with the collection of radiological and

non-radiological exposure histories and work histories. These will allow for subsequent follow-up, by the AECB, of health outcomes (mortality, morbidity, and genetic effects) and will be of use for reporting purposes to registries (dose, exposure or disease), and for other legislative or regulatory requirements.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$30K	$45K			$75K

Project Manager: K.P. Ho
Proponent: HRS, M. Smith (Statistics Canada)
Category: 1
Evaluator: RPD
Review Panel: No

85.8.18 Epidemiological Study of Genetic Disorders in Adults

It is proposed to fund the ongoing epidemiological study of genetic disorders among adults in British Columbia. Genetic disorders among a cohort of nearly 20,000 persons born before 1952 will be analyzed using the most recent classification codes.

This proposal is an update of an earlier British Columbia study of childhood genetic defects among a cohort of nearly 60,000 children born between 1952 and 1982. The AECB-funded study was completed in FY 85/86 with the recommendation that adulthood genetic defects among those born prior to 1952 should also be investigated to minimize any bias of underestimating the risk of radiation-induced genetic defects.

It is anticipated that the results of the study will improve the risk estimates for radiation-induced genetic disorders.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$50K	$30K	$50K	$20K		$150K

Project Manager: V. Elaguppillai
Proponent: H. Newcombe (EX-AECL), HRS
Category: 1
Evaluator: RPD
Review Panel: No

85.8.19 In Vitro Study of the Search for Radio-Sensitive Subpopulations in Humans

It is proposed to fund the study of the search for a radio-sensitive human subpopulation by investigating the sensitivity of progenitor cells in human bone marrow. Bone marrow progenitor cells obtained from healthy volunteers will be irradiated with x-rays and the sensitivity of these cells to x-rays will be measured using fluorescent-labelled monoclonal antibodies of human superoxide dismutase.

Irradiation of bone marrow progenitor cells is a major cause of radiation-induced leukemia. Recent animal studies have demonstrated the existence of a radio-sensitive subgroup of progenitor cells in bone marrow, and the size of this subgroup is thought to vary from one animal to another, depending on their relative radio-sensitivities. No such studies have been done in humans. If such a subpopulation is found to exist in humans, it will influence our understanding of the dose-effect relationship for the induction of leukemia.

It is anticipated that the results of the study will be used to demonstrate whether or not there exists a subpopulation in Canada which is more radio-sensitive to the induction of leukemia. If such a subpopulation is found to exist, measures may be able to be taken to protect it against radiation-induced leukemia. Additionally, identification of such a subpopulation would result in the improvement of risk estimates for radiation-induced cancers. (A joint study with AECL and the University of Manitoba on an equal cost-sharing basis.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$53K	$20K		$73K

Project Manager: E. Rabin

Proponent: A. Petkau (AECL-WNRE), HRS

Category: 3

Evaluator: RPD

Review Panel: No

85.8.20 Screening of Human Populations for Abnormal Radiosensitivity

It is proposed to fund a project which is intended to develop a relatively inexpensive and rapid assay to screen for inherited differences in radiosensitivity of individual radiation workers (and prospective radiation workers).

This project is proposed because in recent years, there has been "increasing recognition that there are human genotypes that confer both increased cancer risk and abnormal cellular sensitivity on exposure to carcinogenic agents, including ionizing radiation." Subgroups of human populations possessing these genotypes affect the distribution of risk. Depending on the degree of heightened sensitivity, the average dose-response relationship may significantly underestimate the risk for low dose or low dose-rate exposure of the sensitive individuals. The carriers of the "defective" genotypes are often not identifiable by common clinical tests. An ability to detect such persons on an occupation-wide basis could lead to improved protection for radiation workers and greater comprehension of how risk is distributed. An appreciable side-benefit could accrue from the practical application of such a screening assay: persons identified as "normal" would be somewhat less at risk than was previously supposed. The principle of such an assay currently exists in the cultured fibroblast, colony-forming ability assay. However, the fibroblast assay is too labour-intensive and expensive (estimated cost approximately $5,000 per

assay procedure to test for sensitivity to ionizing radiation) to be used in screening large numbers of persons, and additionally too slow (establishment of the primary culture and survival analyses can take 6 to 8 months).

It is anticipated that the results of this study will lead to a technique for routine screening for inherited differences in radiosensitivity of subpopulations of radiation workers. Information obtained from routine screening of these subpopulations may impact upon the exposure-risk estimates currently forming the basis for the AECB occupational limits for exposure to ionizing radiation due to a necessary reevaluation of the distributions of risk derived from epidemiological studies. (A joint study with AECL on an equal cost sharing basis.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$101K	$117K	$56K	$274K

Project Manager: E. Rabin
Category: 1
Proponent: D.K. Myers (AECL-CRNL), N.E. Gentner (AECL-CRNL), HRS
Evaluator: RPD
Review Panel: Yes

85.8.21 Epidemiological Study of Lung Cancer among Uranium Miners of Eldorado Resources Ltd.

It is proposed to fund the ongoing epidemiological study of lung cancer among uranium miners of Eldorado Resources Ltd. In this phase of the study, smoking data of the miners will be collected and analyzed and the risk estimates for lung cancer will be re-evaluated taking smoking data into account.

Previous risk estimates for lung cancers obtained from the study of uranium miners of Eldorado Resources Ltd. did not take smoking into account. Because of the known association between smoking and lung cancer, it is important to correct the risk estimates for the influence of smoking.

It is anticipated that the results of the study will improve the risk estimates for lung cancer due to exposure to radon daughters. (This a joint study with the National Cancer Institute of Canada (NCIC).)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$45K			$45K

Project Manager: V. Elaguppillai
Category: 1
Proponent: G. Howe (NCIC), HRS
Evaluator: M. Measures (RPD)
Review Panel: No

85.8.22 In Vitro Study of the Effect of Ionizing Radiation on the Developing Central Nervous System

It is proposed to fund the in vitro study of the effect of exposure to external gamma radiation on the developing central nervous system of rat embryo, using whole embryo culture.

It is anticipated that an increasing number of Canadian women will seek employment in the nuclear industry, where, in some cases, exposure of embryos or fetuses might occur. Although mental retardation has been found to be the major developmental defect among those who received in utero exposure in the Japanese nuclear explosion, very little information is available in the literature about the effect of radiation on the function and structure of the brain. This in vitro study will help in the understanding of the problem. UNSCEAR (Draft Report A/AC-82/R-424, 1984) has also identified the need for such research.

It is anticipated that the results of the study will assist in the quantification of the risk of in utero exposure to ionizing radiation on the developing central nervous system. (A joint study with the University of Manitoba and the Children's Hospital Research Foundation of Manitoba, Winnipeg, on an equal cost-sharing basis.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K	$25K	$30K	$95K

Project Manager: V. Elaguppillai

Category: 3

Proponent: Review Panel for the current project on Central Nervous System (84.8.8)

Evaluator: RPD

Review Panel: Yes

86.8.2 Sensitivity of Bronchial Epithelial Cells to Alpha Radiation

It is proposed to investigate the relative sensitivities of human bronchial epithelial cells to alpha radiation of energies of 8 MeV and below. This laboratory study will focus on the production of non-lethal chromosome aberrations in cells grown in a culture medium.

This study is proposed because the process of initiating lung cancer in humans by exposure to alpha radiation (such as is believed to occur in uranium mines) is not well understood. The cells of the bronchial epithelium which, upon absorption of alpha energy, initiate the development of lung cancer have not been identified with certainty.

It is anticipated that the findings of this study will provide information that is pertinent to understanding the mechanism of lung cancer induction by alpha radiation. (The proponents of this project formed a working group of Joint Panel on Occupational and Environmental Research for Uranium Production.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K	$60K		$100K

Project Manager: E. Rabin
Category: 3
Proponent: HRS, RPD, D. Brown (Sask. Dept. of Labour)
Evaluator: C. Pomroy (RPD)
Review Panel: No

86.8.3 Adapting Dosimetric Models for Use on AECB EDP

It is proposed to extract respiratory tract and gastrointestinal tract dosimetric models from the AECL main dosimetric model called GENMODE, and to translate them into a form for use by the AECB EDP system. Metabolic data that are part of GENMODE will be presented on a database format on separate diskettes.

GENMODE is a general dosimetric model that combines the ICRP lung model, a gastrointestinal tract model, and a compartment model for uptake and retention of radionuclides by the body's organs. Metabolic parameters regarding organs and compartments, as well as radionuclides of concern in occupational and environmental radiation protection are assembled in a database. The dose to target organs, the Committed Effective Dose Equivalent following unit intake and the subsequent excretion rates can be computed from GENMODE and its associated database. For regulatory activities, it is possible to split GENMODE into autonomous sub-programs that can be used on microcomputers to calculate ALIs, DACs, excretion rates and Committed Effective Dose Equivalents under specific conditions. The various sub-programs and databases can be made compatible to cover a range of routine and accident situations encountered by licensees of the Board.

The availability of dosimetric programs and data bases will enable the Board staff to determine more easily operational ALI and DAC values, when needed, and to assess the adequacy of monitoring techniques under routine and accident situations.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$40K	$20K		$60K

Project Manager: P.J. Duport
Category: 1
Proponent: HRS
Evaluator: F. Horvath (RPD)
Review Panel: No

86.8.4 Study of the Health Effects of Low-Level Exposure to Environmental Radiation in Port Hope

By means of a literature review, interviews, and case control studies, it is proposed to: a) evaluate the health effects of low-level exposure to environmental radiation; measure the magnitude of risk of lung cancer induced by low-level alpha radiation; study the association

between gamma radiation and leukemia; and b) determine the importance of environmental radiation in relation to the other major cancer risk factors and assist in the establishment of a relationship between radiation-induced cancer and radiation exposure.

This project is proposed because, in 1980, a case-control study of lung cancer among Port Hope residents turned out to be inconclusive. The earlier study was conducted in order to try to evaluate the relative importance of domestic radiation exposure due to radioactive contamination of homes from industrial sources. Based on 12 years of lung cancer incidence (1966-1977) and the information from radiation surveys, the study showed an elevated risk ratio in homes with elevated radon levels. However, because of the limited sample size, the association between lung cancer and radiation contamination did not reach a statistically significant level. Also, the design and analysis of the study have been criticized because of the small number of cancer cases, the questionable selection of controls, the effect of potential co-carcinogens which were not investigated, and the absence of investigations on leukemia. It is now possible to extend the 1980 study by utilizing 18 additional cases of lung cancer (compared to the original 27 in 1980 study) and by including all cases of leukemia. Controls will be selected and co-carcinogens investigated according to state-of-the-art techniques, and a new questionnaire will be compatible with that of the 1980 study, with additional questions on dietary habits. It is intended to include workers from Eldorado Nuclear Ltd. in the study.

It is anticipated that the results of the study will complement the Board's knowledge of the long-term effects of exposure to low-level alpha and gamma radiations, and will bring information on how the aging of an exposed population influences the results of epidemiological studies. The proposed study should also indicate how other parameters such as dietary habits, medical history and other non-radiological carcinogens influence the outcome of a case-control study on the health effects of radiation.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$50K	$15K	$125K

Project Manager: V. Elaguppillai
Category: 3
Proponent: D. Wigle (NHW), HRS
Evaluator: RPD
Review Panel: Yes

86.8.6 Study of the Recovery of Kidney Tissue from the Toxic Effects of Uranium

It is proposed to conduct animal experiments with a view to re-evaluating the chemical toxicity of uranium. The study will concentrate on the extent and rate of recovery from tissue damage following nephrotoxic effects, and will seek to select routine urine tests that will give good indications of kidney function.

There is evidence from animal experiments that observable kidney damage occurs at concentrations of uranium in tissue, as low as 1 microg/g, although the present recommended maximum permissible limit is 3 microg/g. However, the links between histopathology and kidney function are uncertain, and although recovery of renal function has been observed, the rate and the extent of tissue recovery from damage caused by uranium is not well known, and no simple test exists yet that can be used to monitor the renal functions of uranium workers.

It is anticipated that the results of the study will increase the Board's knowledge of nephrotoxic effects associated with uranium intake, and will indicate the extent and rate of tissue recovery. The results derived from the routine urine tests are expected to indicate the feasibility and reliability of the monitoring of renal functions in uranium workers.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$60K	$80K	$40K	$180K

Project Manager: P.J. Duport

Proponent: HRS, RPD, D. Brown (Sask. Labour)(Members of a Working Group of the Uranium Joint Panel)

Category: 3

Evaluator: C. Pomroy (RPD)

Review Panel: Yes

86.8.8 Cancer Morbidity Follow-Up Feasibility Study Using the National Dose Registry of Canada

It is proposed to determine the feasibility of using morbidity data sources available in Canada for individual medical follow-up studies by attempting to link the National Dose Registry with the Alberta Cancer Registry to determine any association between occupational radiation exposure levels and cancer incidence. It is further proposed to use a case-control methodology in which groups of individuals are selected based on whether or not they have the disease, in this instance, as collected by the Alberta Cancer Registry.

This feasibility study is proposed because morbidity data will greatly assist the AECB in determining whether any excessive health effects or risks exist due to exposure to certain potentially hazardous environmental, occupational or other factors. This information will both complement and supplement mortality data available through the Canadian Mortality Data Base by providing a more sensitive measure (than mortality data alone) of the differences in risk from exposure to potentially hazardous environmental, occupational or other factors and a possible earlier detection of any potential health hazard.

It is anticipated that this study will provide the AECB with: (i) the ability to draw upon more cancer data from Canadian sources; and (ii) the opportunity to detect the occurrence of any non-fatal or rare cancers. In addition, it will assist the AECB in identifying areas of

occupational, environmental, and other health risks for the general public, will aid the AECB in its regulatory activity and finally will help in providing information for the assessment of exposures and occupational hygiene practices.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K	$20K		$50K

Project Manager: K.P. Ho

Category: 3

Proponent: HRS, M. Smith (Statistics Canada)
Evaluator: RPD
Review Panel: No

86.8.9 Adequacy of Relative and Absolute Risk Models for Lifetime Risk Estimates of Radiation-Induced Cancers

It is proposed to fund a literature review to examine the degree of adequacy with which relative and absolute risk models permit lifetime risk estimates for different cancers.

There is some controversy as to which of the two risk models, relative or absolute, are applicable for lifetime risk estimates. Since the two models often result in different risk estimates, depending on a number of factors such as the type of cancer and the ages of the individuals within the cohorts, it is important to understand their strengths and weaknesses in different applications.

It is anticipated that the results of the study will enable the AECB to improve the understanding of the relative strengths and weaknesses of the two models for lifetime risk estimates for radiation-induced cancers.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$12K			$12K

Project Manager: V. Elaguppillai

Category: 1

Proponent: HRS, M. McBride (Cancer Control Agency of British Columbia)
Evaluator: RPD
Review Panel: Yes

86.8.10 Bibliography of Publications on Computerized Record Linkage in Health Research

As a follow-up to the Workshop on Computerized Record Linkage in Health Research, May 1986, it is proposed to establish an updated bibliography of publications related to computerized record linkage in health research. The bibliography will be assembled on a micro-computer diskette in a format suitable for publication. The standard supporting software will make up-dating easy. One section of the bibliography will deal specifically with health effects of radiation.

The last bibliography assembled in this domain was prepared in 1970, by G. Wagner and H.S. Newcombe for the Medical Research Council of Canada. Since that time, computer techniques and the ethics of dealing with personal records in computer files have evolved considerably. It has also been shown that epidemiological studies can be powerful tools when they link health effects to large numbers of parameters, provided that linkage techniques between computer files are available and are ethically acceptable.

It is anticipated that the proposed bibliography will provide a comprehensive current list of all published work using record linkage for radiation and other health studies. Such a bibliography will be useful in disseminating information, in encouraging interaction and collaboration on future research, and in avoiding duplication of efforts among departments and agencies. (This is a joint study between AECB and Statistics Canada.)

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$25K			$25K

Project Manager: P.J. Duport

Category: 3

Proponent: M. Smith (Statistics Canada), HRS
Evaluator: RPD
Review Panel: No

86.8.11 Hospital Record-Keeping System for Case-Control Epidemiological Studies - A Feasibility Study

It is proposed to conduct a feasibility study to modify hospital record-keeping systems to facilitate inexpensive case-control epidemiological studies of radiation-induced health effects.

Case-control studies of radiation-induced health effects can be conducted inexpensively using hospital records. However, the record-keeping systems in Canadian hospitals are not currently in a format to facilitate such studies.

It is anticipated that the results of the study will determine the feasibility of modifying hospital record-keeping systems. If the modification is feasible, several epidemiological studies of radiation-induced health effects can be conducted inexpensively to improve risk estimates.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$50K			$50K

Project Manager: V. Elaguppillai

Category: 3

Proponent: S. Raman (U. of Ottawa), HRS
Evaluator: RPD
Review Panel: Yes (Provincial Epidemiologists, see 84.8.13)

86.8.12 Selection of Control Groups for Use in Epidemiological Studies of Radiation-Induced Health Effects

It is proposed to fund the development of a unified system of selecting control groups for use in epidemiological studies of radiation-induced health effects.

One of the major problems in interpreting the results of epidemiological studies of groups exposed to ionizing radiation is the general lack of comparability between different studies of similar groups. The main source of the problem is the variation of the quality of control groups used in the different studies. It is therefore essential to develop a comprehensive system or methodology for selecting control groups for use in Canadian epidemiological studies of radiation health effects. Lack of uniformity in selecting control groups has also been recognized as a weakness in epidemiological studies in member countries of the OECD. (Dr. Joan Davies, OECD, Report No. SAN/DOC(84)5.)

It is anticipated that the results of the study will provide a unified system or methodology of selecting control groups for use in epidemiological studies of radiation-induced health effects.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$30K			$30K

Project Manager: V. Elaguppillai

Proponent: Review Panel of Provincial Epidemiologists (See 84.8.13), HRS

Category: 3

Evaluator: RPD

Review Panel: Yes

9. Regulations & Regulatory Process Development

84.9.3 Methodologies for Evaluation of AECB Regulatory Programs

It is proposed to conduct a literature search and to prepare an annotated bibliography of program evaluation studies and reports, and other relevant material concerned with the evaluation of regulatory programs similar to the regulatory programs of the AECB. The project will also include a review and summary of the advantages and disadvantages of the various methods of evaluation used and will indicate the type of information required to use the various evaluation methods. Later phases of this research may be used to develop appropriate methodologies if none exist.

This project is being proposed because Treasury Board Policy Circular 1977-47, "Evaluation of Programs by Departments and Agencies" states that: "Departments and agencies of the federal government will periodically review their programs to evaluate their effectiveness in meeting their objectives and the efficiency with which they are being

administered." Currently, there is limited information on methodologies for evaluating regulatory programs in Canada. However, regulatory agencies in other countries may have some experience in this area, and Canadian and foreign experience in the program evaluation of other regulatory areas may be applicable to the Canadian nuclear regulatory program.

It is anticipated that the information obtained from this project will be used in the design of the program evaluation assessments and studies in the implementation of the AECB's Program Evaluation Plan. The information would also be made available to other interested Canadian regulatory agencies, through the OCG Working Group on the Evaluation of Regulatory Programs.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
	$30K	$8K			$38K

Project Manager: C. St-Arneault
Category: 1
Proponent: P&CD
Evaluator: L.L. Trudel
Review Panel: No

85.9.2 Socio-Economic Impact Analysis of Proposed General Amendments to Atomic Energy Control Regulations

It is proposed to investigate the socio-economic impact of the intended General Amendments to the Atomic Energy Control Regulations. The incremental costs and benefits of these regulations to the Canadian nuclear industry and other users of radioactive materials as well as to Canadian society in general will be predicted and subjected to cost-benefit or related analysis.

This work is being proposed in accordance with Treasury Board requirements concerning new major health, safety and fairness regulations. It is not yet known whether these amendments will have a "major" impact as defined in Chapter 490 of Treasury Board's Administrative Policy Manual, and hence the need for a socio-economic impact analysis has not yet been confirmed. However, the AECB anticipates that the level of public concern likely to be produced by these amendments will justify the performance of such an analysis. The AECB must determine whether any part of the proposed amendments to the regulations would pose unjustified costs and whether these amendments are the most effective means of meeting the objectives of health, safety, and environmental protection.

It is anticipated that the results of this study will aid the AECB in its review of the proposed amendments. In addition, this study is expected to be used to satisfy Treasury Board requirements.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
		$140K			$140K

Project Manager: C. St-Arneault
Category: 1

Proponent: Senior Review Group
Evaluator: Senior Review Group
Review Panel: Senior Review Group

86.9.1 Uranium Mine Radiation Safety Course

It is proposed to continue to fund the two sessions of the Uranium Mines Radiation Safety Course (UMRSC), one to be held in the spring in Saskatoon, Saskatchewan, the other in the autumn in Elliot Lake, Ontario. (The first course in this series was held in Elliot Lake in May, 1976.)

This course is designed to provide participants with the basic understanding of radiological hazards to workers and to the environment. It also presents practical approaches to deal with these hazards. The philosophy and regulatory approach of the AECB are discussed.

It is anticipated that this course will continue to provide uranium mine radiation safety principles to mine supervisors, inspectors and operations personnel, and to representatives from regulatory agencies, mining companies and unions, who are directly involved in radiation safety.

Past	FY 85/86	FY 86/87	FY 87/88	Future	Total
$333K	$64K	$75K	$80K		

Project Manager: K.P. Ho
Category: 1

Proponent: UMD
Evaluator: J. Viljoen, A. Dory (UMD)
Review Panel: No

SUMMARY ANALYSIS OF AECB R & D DRAFT BUDGET

BY MISSION OBJECT

(FY 86/87 BUDGET ALLOCATION: $2,993,000)

MISSION OBJECT	FY 86/87 BUDGET ALLOCATION (K$)		
	CATEGORIES 1 & 2	CATEGORY 3	TOTAL
1. NUCLEAR REACTORS	1,044	365	1,409
2. HEAVY WATER PRODUCTION PLANTS	-	-	-
3. URANIUM MINES AND MILLS	292	60	352
4. OTHER FUEL CYCLE FACILITIES	395	90	485
5. WASTE MANAGEMENT	472	-	472
6. NON FUEL CYCLE APPLICATIONS	140	-	140
7. TRANSPORTATION	84	-	84
8. HEALTH PHYSICS	1,271	448	1,719
9. REGULATIONS & REGULATORY PROCESS DEVELOPMENT	223	-	223
10. SECURITY	-	-	-
TOTALS	3,921	963	4,884